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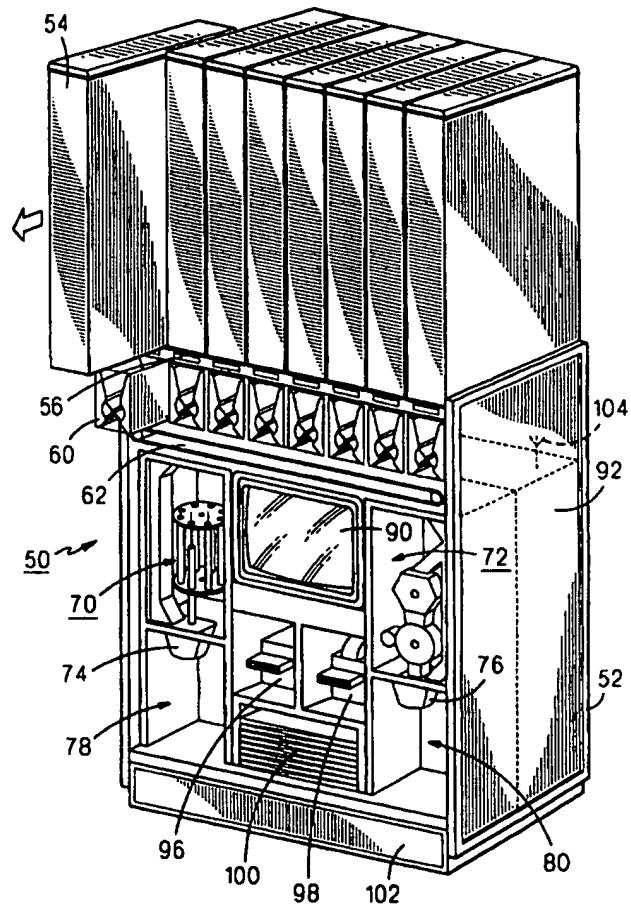
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(54) Title: COFFEE BEAN BLENDING APPARATUS AND METHOD

## (57) Abstract

In a preferred embodiment, a coffee bean blending apparatus (50), comprising: a housing (52); a plurality of storage bins (54) disposed in said housing (52), in which storage bins (54) are to be placed coffee beans; each of said storage bins (54) having associated therewith discharging means (60) to mechanically discharge said coffee beans therefrom; and conveying means (62) to collect discharged coffee beans from said discharging means (60) and to selectively convey said discharged coffee beans to at least a first dispensing location (74).



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DescriptionCoffee Bean Blending Apparatus and Method

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Technical Field

The present invention relates to the blending of coffee beans in retail establishments generally and, more particularly, but not by way of limitation, to 10 novel apparatus and method for blending coffee beans that overcome many disadvantages of conventional coffee bean blending systems.

Background Art

15 Custom blended coffee has become increasingly popular, both in retail establishments that custom blend coffee for grinding and consumption on the premises and in retail establishments that sell custom blended coffee beans.

20 In a typical system for blending coffee beans, there is provided a plurality of bins each having a spigot attached to the bottom thereof. A customer, usually with the assistance of a clerk, opens the spigots in turn on selected bins and discharges selected 25 quantities of coffee beans into a container. Often, after each discharge, it is necessary to weigh the container, due to different prices for different beans. The process is labor intensive and results in inventory shrinkage because beans are frequently spilled on the 30 floor, also causing a safety hazard.

Since flavored coffee beans are popular, the retailer must have many different beans available. For example, the retailer might have to have enough bins to be able to dispense caffeinated and decaffeinated 35 columbian coffee beans in perhaps half a dozen flavors, requiring a total of 12 bins for only one type of coffee bean. A problem with inventorying large numbers of different types of coffee beans is that the retailer

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does not know which beans are likely to become popular and, therefore, many will become stale before being sold. While techniques are available for mixing flavors with coffee beans on a large scale by coffee bean 5 distributors, there has been no satisfactory technique for mixing flavors with coffee beans on a retail scale.

There has recently been developed a coffee bean blending system which employs a plurality of bins with screw-type unloaders which discharge to a grinder, the 10 grinder discharging to a container. It has been found that it is difficult to control flow with this type of system.

Another consideration in any coffee bean blending operation is that flavored and non-flavored coffee beans 15 must be kept absolutely separated and that the same equipment for handling the one type of coffee bean cannot be used to handle the other type. Of course, individual flavorings must be isolated from each other.

Accordingly, it is a principal object of the 20 present invention to provide coffee bean blending apparatus and method that is accurate.

It is a further object of the invention to provide such apparatus and method that minimize labor required of a retailer.

25 It is an additional object of the invention to provide such apparatus and method that minimize inventory shrinkage.

It is another object of the invention to provide such apparatus and method that reduce the number of 30 different coffee beans that must be inventoried, yet permit dispensing a large number of different flavored coffee beans.

A further object of the invention is to provide such apparatus and method that ensures that flavored and 35 non-flavored coffee beans are not mixed and are not handled by the same equipment.

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An additional object of the invention is to provide such apparatus and method that permit automated and accurate inventory accounting, records to the customer, and data collection.

5 Another object of the invention is to provide such apparatus that is easily serviced.

Other objects of the present invention, as well as particular features, elements, and advantages thereof, will be elucidated in, or be apparent from, the 10 following description and the accompanying drawing figures.

#### Disclosure of Invention

The present invention achieves the above objects, 15 among others, by providing, in a preferred embodiment, a coffee bean blending apparatus, comprising: a housing; a plurality of storage bins disposed in said housing, in which storage bins are to be placed coffee beans; each of said storage bins having associated therewith 20 discharging means to mechanically discharge said coffee beans therefrom; and conveying means to collect discharged coffee beans from said discharging means and to selectively convey said discharged coffee beans to at least a first dispensing location.

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#### Brief Description of Drawings

Understanding of the present invention and the various aspects thereof will be facilitated by reference to the accompanying drawing figures, submitted for 30 purposes of illustration only and not intended to define the scope of the invention, on which:

Figures 1-4 are isometric views of a coffee bean blending apparatus according to the present invention.

Figure 5 is a side elevational view, Figure 6 is a 35 top plan view, and Figure 7 is an end elevational view showing the portion of the apparatus on which a coffee bean silo is placed.

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Figure 8 is a fragmentary, cross-sectional, side elevational view, taken along line "8-8" of Figure 9 and Figure 9 is a top plan view of the bottom portion of a coffee bean silo.

5 Figures 10-13 are fragmentary, side elevational views showing the steps of installing a coffee bean silo in the apparatus, with the simultaneous opening of the bottom of the silo to discharge coffee beans.

10 Figure 14 is a fragmentary, side elevational view showing a method of preventing coffee beans in a silo from sticking together.

Figures 15 and 16 are fragmentary, side elevational views showing an arrangement for detecting when the quantity of coffee beans in a silo is low.

15 Figure 17 is a side elevational view of a coffee bean dispensing module.

Figure 18 is an isometric view of the dispensing element of the dispensing module.

20 Figure 19 is a front elevational, schematic view showing various paths of coffee beans and ground coffee through the apparatus.

25 Figure 20 is a combined side elevational and plan view and Figures 21 and 22 are side elevational views showing the elements and use thereof for dispensing liquid flavoring to coffee beans.

Figures 23 and 24 are isometric views of the apparatus showing use of a security cover.

30 Figure 25 is a schematic/block diagram showing control/communication interconnections of the elements of the apparatus.

Figures 26 through 32 comprise a flowchart showing use of the apparatus.

Figure 33 shows a bag label produced by the apparatus.

35 Figure 34 shows a customer membership card produced and used by the apparatus.

Best Mode for Carrying Out the Invention

Reference should now be made to the drawing figures, on which similar or identical elements are given consistent identifying numerals throughout the 5 various figures, and on which parenthetical references to figure numbers direct the reader to the view(s) on which the element(s) being described is (are) best seen, although the element(s) may be seen also on other views.

Figures 1-4 illustrate a coffee blending 10 apparatus, generally indicated by the reference numeral 50, and constructed according to the present invention.

Apparatus 50 includes a housing 52 mounted on the top of which is a plurality of modular transparent silos, as at 54, each containing a different type of 15 coffee bean (not shown) and each having disposed in the front thereof an identifying label, as at 56. As is indicated on Figure 2, an individual modular coffee bean silo 54 may be easily removed or slid into place without any other action. Opening of the bottom of the silo is 20 accomplished automatically, as is described below with reference to Figures 10-13.

Mounted underneath each silo 54 is a transparent coffee bean dispenser module, as at 60, disposed so as to discharge coffee beans onto a conveyor belt 62. As 25 is indicated on Figure 3, an individual modular coffee bean dispenser 60 may be easily removed or slid into place without any other action. Conveyor belt 62 is operable to move coffee beans to the left to discharge the coffee beans into a flavoring module, generally 30 indicated by the reference numeral 70 (Figure 4), or to the right to discharge the coffee beans into a grinder module 72, generally indicated by the reference numeral 72 (Figure 4). Modules 70 and 72 discharge beans into suitable containers (not shown) through, respectively, 35 discharge nozzles 74 and 76 in discharge compartments 78 and 80. Modules 70 and 72 are also readily removed and

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replaced, as is the case with silos 54 and dispensers 60.

Completing the major elements of coffee blending apparatus 50 are a video display/touch screen 90, a 5 computer 92 (Figure 4), a sniff bar 94 (Figures 1-3), an ID card reader/printer module 96, a bar code label printer 98 and bag dispenser, and a spilled bean drawer 100, the latter element for collecting any beans that 10 are spilled in apparatus 50. Mounted on computer 92 is a cellular telephone antenna 104 for remote communications with a distributor/service facility.

Sniff bar 94 includes a number of transparent, hinged doors, as at 110, each covering a small compartment containing coffee beans, and each being 15 openable so that a customer may smell the aroma of the beans therein, thus eliminating the typical process of allowing the customer to sniff the main supply of beans directly or discharging a few beans for the customer to sample the aroma thereof. The beans in a compartment 20 are placed in a plastic bag having a label visible through a hinged door and having small holes through the wall of the bag to release the aroma. The beans are easily changed by simply removing one plastic bag and replacing it with another.

25 Figures 5, 6, and 7 illustrate the portion of housing 52 for mounting and opening the bottom of a coffee bean silo 54 (Figures 1-4), including parallel, longitudinally extending side rails 120 and 122 fixedly attached to the housing (Figures 1-4). Vertically 30 movably attached to side rails 120 and 122 and extending therebetween is a push plate 124 having a flat, horizontal central portion 126 and flat, front and rear portions 128 and 130, respectively, attached to the central portion and sloping downwardly away from the 35 central portion. A latch plate 132 is fixedly attached to the upper surface of central portion 126 and extends upwardly therefrom. Push plate 124 is biased to its upwardmost position, shown on Figures 5-7 by means of a

coffee bean dispenser 60 and its drive motor 140, the dispenser being indicated also on Figure 6.

Figures 8 and 9 illustrate the bottom portion of a silo 54, which includes a flat, horizontal, slide cover 150 movable back and forth in a cover slide tracks 152 formed at either side of the silo. Cover 150 includes a slide cover opening 160 and a latch opening 162, both defined through the slide cover. Downwardly extending push bars 164 are fixedly attached to the inside 10 surfaces of the sides of silo 54 and are set inwardly therefrom somewhat to clear cover slide tracks 152. Also shown on Figure 8 are a sloped bottom portion 170 of silo 54 which forms a discharge chute for coffee beans 172, a silo drop opening 174, and silo slide 15 tracks 176 formed at each side of silo 54. It can be seen on Figure 8 that slide cover 150 covers silo drop opening 174 when silo 54 is not installed in coffee blending apparatus 50.

Figures 10-13 illustrate the installation of a 20 silo 54 in coffee blending apparatus 50 (Figures 1-4). On Figure 10, installation in the direction of the arrow is just beginning and slide cover 150 is in its closed position, as is also shown on Figure 8. Referring to Figure 11, silo 54 has been moved farther to the right 25 and push bars 164 have engaged and depressed push plate 124, compressing spring 134, so that the rear edge of slide cover 150 can clear latch bar 132. On Figure 12, silo 54 has been moved sufficiently to the right that latch plate 132 has entered and engaged latch opening 30 162 such that further movement of silo 54 to the right in the direction of the arrow will cause slide cover 150 to move to the left. On Figure 13, slide cover 150 has been moved fully to the left such that slide cover opening 160 and silo drop opening 174 are aligned to 35 permit coffee beans 172 to fall into dispenser 60 and silo 54 is now fully installed. A fixed stop is

provided for the engagement thereof by the rear edge of slide cover 150 to minimize strain on push plate 124.

Figure 14 illustrates a feature of the present invention which facilitates the handling of coffee beans with a high oil content. It has been found that when discharging such beans from silo 54, they have a tendency to stick together and bridge over silo drop opening 174. The invention solves this problem by providing an electric motor 200 mounted under sloped bottom portion 170 and having a shaft 202 extending through the sloped bottom portion, with an agitator 204 attached to the shaft. Motor 200 is connected in parallel with motor 140 (Figures 10-13) such that agitator 204 will turn whenever motor 140 is operating, to prevent the bridging of coffee beans 172.

Figures 15 and 16 illustrate a feature of the present invention which provides an indication that the quantity of coffee beans 172 in silo 54 is low. Sloped bottom portion 170 is arranged such that it is rotatable about a hinge 220 to which its lower edge is attached. A microswitch 222 is fixedly disposed below the lower surface of sloped bottom portion 170, with the actuating arm of the microswitch in contact with the lower surface. A spring 224 in contact with the lower surface of sloped bottom portion 170 is compressed when silo 54 is full of coffee beans 172, as is shown on Figure 15. As beans 172 are dispensed, sloped bottom portion 170 slowly rises and when a predetermined quantity of beans remains, say two pounds, for example, as is indicated on Figure 16, microswitch 222 is actuated and an appropriate signal may be given to the proprietor of the retail establishment in which coffee bean blending machine 50 is located and/or to a local distributor.

Figure 17 illustrates a coffee bean dispenser module 60. Module 60 is a rotary valve with four relatively rigid vanes 320, 322, 324, and 326 fixed to a rotatable shaft 328 which is rotatably attached to a front cover 330 and a similar rear cover. The rear of

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shaft 328 engages motor 140 (Figures 10-13) through the rear cover of module 60 when the module is installed in housing 52 (Figures 1-4). Vanes 320, 322, 324, and 326 closely engage arcuate portions of sidewalls 340 and 342. Sloped upper portions of sidewalls 340 and 342 define an inlet chute 350 for coffee beans 172, while the lower portions of the sidewalls define an outlet chute 354 for discharging the measured amount of beans onto conveyor belt 62, by rotation of shaft 128 in 90-degree increments.

Referring to Figure 18, each of vanes 320, 322, 324, and 326 has a layer of 10-mil mylar adhesively attached thereto, such as layer 360 on vane 324. Formed at the distal edge of layer 360 is a plurality of 1/4-inch by 1/4-inch tabs, as at 362. These tabs slidingly engage the inner arcuate surfaces of sidewalls 340 and 342 and prevent the jamming of coffee beans 172. It is known to use brushes on the edges of vanes to prevent jamming of materials in rotary valves; however, it has been found that the mylar sheets of the present invention are much more easily attached.

Figure 19 illustrates the paths that coffee beans may take after discharge from conveyor 62. As is noted above, conveyor 62 may be operated to transport the coffee beans to the left to flavoring module 70 or to the right to grinder module 72. If the beans are transported to the left, they fall into a chute 400 disposed in flavoring module 70 and through that chute into a bag 402. Then, flavoring is added to the beans in bag 402 by a flavor carousel 404, as is described below. If beans are transported to the right to grinder module 72, they fall into the mouth of a chute 410. Then, depending on the positional setting of a diverter valve by computer 92 (Figure 4), the beans may pass through a grinder 412 in module 72 and then into a bag 414 or they may continue through the chute and pass unground into the bag.

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The present invention also contemplates that two banks of silos may be provided, one for flavored beans and the other for non-flavored beans. In that case, flavoring module 70 would be replaced with another 5 grinder module and separate conveyors would be provided to convey flavored beans to one module and non-flavored beans to the other module, in order to maintain separation of flavored and non-flavored beans and the equipment used to handle them. With this arrangement, 10 there would also be a choice of the grinding or not of flavored beans.

Figure 20 illustrates the construction and partial operation of flavor carousel 440. Carousel 440 includes a rotatable selector wheel 500 which is frictionally 15 selectively rotated by a selector wheel drive motor 502 through a circular drive puck 504. Selector wheel 500 has a plurality of circular openings defined therethrough, as at 510, each opening having an associated detent, as at 512, defined in the edge of the 20 selector wheel. A microswitch 514 is disposed to sense the detents and, in conjunction with computer 92 (Figure 4) and motor 502, provides a system for rotating selector wheel 502 to a selected opening 510. A microswitch 520 and associated detent provide a known 25 home position.

Each opening 510 has mounted therein a flavor tube, such as flavor tube 530. It should be noted that selector wheel 500 is shown in plan view, while flavor tube 530 and bag 402 are shown in side elevational 30 view. Flavor tube is shown as being engaged by an elevator yoke 532 which is selectively raised or lowered by means of a continuous belt 534 attached to the elevator yoke and passing around the drive shaft of a motor 536 and around idler wheels 538 and 540. The 35 lower end of flavor tube can thus be lowered into bag 402, at which point a gear 548 on flavor tube 530 will engage dispensing gear 550 rotated by a motor 552 to dispense liquid flavoring into bag 402, as is described

in more detail below. Limit switches 560 and 562 detect up and down positions, respectively, of flavor tube 530.

Referring now to Figures 21 and 22, elevator yoke 532 engages a tube yoke 570 attached to the top of flavor tube 530 and in which tube yoke gear 548 is rotatably captured. Gear 548 has a threaded central opening 572 which engages a threaded rod 574, with selective rotation of the gear causing raising or lowering of the threaded rod with respect to flavor tube 530. The lower end of threaded rod 574 extends into flavor tube 530 and has attached thereto a plunger 580 which is slidingly sealed to the inner wall of the flavor tube by means of an O-ring 582. A dispensing orifice 590 is defined through the wall of flavor tube 530 at the lower end thereof between O-rings 592 and 594. As is shown on Figure 21, with flavor tube in its elevated position, O-rings 592 and 594 form a sealed chamber with selector wheel 500 to prevent flavor liquid 596 in flavor tube 530 from leaking.

Figure 22 shows flavor tube 530 having been lowered by elevator yoke 532 so that the lower end of the flavor tube is inserted into bag 402 and gear 548 is engaged with dispensing gear 550. Now, rotation of gear 548 in the proper direction by dispensing gear 550 will cause plunger 580 to be lowered in flavor tube 530 and flavor liquid 596 to be discharged through dispensing orifice 590 into coffee beans 172. Upper and lower photodetector/light sources 600 and 602, respectively, are provided to signal when flavor tube 530 is full and when it is empty. When empty, flavor tube 530 can be refilled by lowering the lower end of the flavor tube into a container of flavor liquid and raising plunger 580 to draw flavor liquid into the flavor tube through dispensing orifice 590.

Any number of selected flavors and amounts thereof can be added to beans 172. Control of all the operations described above is by computer 92 (Figure 4).

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Figures 23 and 24 illustrate a security cover 650 according to the present invention, the purpose of which is to prevent unauthorized access to the components of coffee bean blending apparatus 50. Note that cover 650 5 is not shown on Figures 1-4. Cover 650 engages vertical channels formed at the front edges of housing 52 to permit sliding the cover upwardly and downwardly in the channels. Cover 650 is locked in place when in normal position and includes openings defined therethrough so 10 that a customer may access those components necessary for use of apparatus 50, but otherwise blocks access to the other components. As indicated on Figure 23, cover 650 is lowered slightly in the channels to unblock the lower edges of silos 54 such that one or more of the 15 silos can be removed. As indicated on Figure 24, if other elements of apparatus 50 require servicing, cover 650 can be completely removed by raising it out of the channels.

Figure 25 illustrates control/communication 20 interconnections of elements previously described and further illustrates a CD player 700 and a cellular telephone 702 connected to computer 92 and bag presence sensors 704 and 706 and bag supply sensor 708 also connected to the computer. The cellular telephone may 25 be used to convey to a central location information as to amounts of different types of coffee beans dispensed, a low coffee bean condition, a malfunction condition, etc.

Figures 26-32 comprise a flowchart showing the 30 steps in selecting and obtaining a desired blend of coffee beans and flavorings, if desired, including the use and obtaining of a Gourmet Coffee Club (GCC) card.

Figure 33 illustrates a bag label, generally indicated by the reference numeral 800, produced by 35 apparatus 50, and including thereon a bar code 802 which may include price and other information encrypted therein. Bar code may simply be scanned at the checkout counter to enter the price in a cash register and that

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is the only labor required on the part of the establishment in which apparatus 50 is located.

Figure 34 illustrates a membership card (GCC), generally indicated by the reference numeral 810, and 5 including thereon a magnetic stripe 812 which may include membership information, customer blend preferences, cumulative total value purchased (for discount programs), and other data. The customer blend preferences may be used to select a favorite blend 10 without the customer having to enter the information.

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All patent applications, patents, and other documents cited herein are incorporated in their entirety by reference hereinto.

It will thus be seen that the objects set forth 5 above, among those elucidated in, or made apparent from, the preceding description, are efficiently attained and, since certain changes may be made in the above construction without departing from the scope of the invention, it is intended that all matter contained in 10 the above description or shown on the accompanying drawing figures shall be interpreted as illustrative only and not in a limiting sense.

It is also to be understood that the following claims are intended to cover all of the generic and 15 specific features of the invention herein described and all statements of the scope of the invention which, as a matter of language, might be said to fall therebetween.

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Claims

1. A coffee bean blending apparatus, comprising:

- (a) a housing;
- 5 (b) a plurality of storage bins disposed in said housing, in which storage bins are to be placed coffee beans;
- (c) each of said storage bins having associated therewith discharging means to mechanically discharge said coffee beans therefrom; and
- 10 (d) conveying means to collect discharged coffee beans from said discharging means and to selectively convey said discharged coffee beans to at least a first dispensing location.

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2. A coffee bean blending apparatus, as defined in Claim 1, further comprising: flavoring means disposed at said at least a first dispensing location to add flavoring to said discharged coffee beans as said 20 discharged coffee beans are dispensed from said apparatus.

3. A coffee bean blending apparatus, as defined in Claim 2, further comprising:

25 (a) a second dispensing location to which said conveying means can selectively convey said discharged coffee beans; and

(b) grinding means disposed at said second dispensing location to grind said discharged coffee beans as said discharged coffee beans are dispensed from said apparatus.

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4. A coffee bean blending apparatus, as defined in Claim 1, wherein: said storage bins and said discharging means are modular and any one of said storage bins and said discharging means may be replaced 5 by manual withdrawal from said housing and manual insertion of a replacement into said housing.

5. A coffee bean blending apparatus, as defined in Claim 1, further comprising: electronic means 10 connected to enable a customer to select desired quantities of said coffee beans and to initiate discharging and dispensing thereof.

6. A coffee bean blending apparatus, as defined 15 in Claim 1, wherein: each of said plurality of storage bins has associated therewith a compartment containing coffee beans of the same type as in said each of said plurality of storage bins to enable a customer to smell said coffee beans of the same type.

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7. A coffee bean blending apparatus, as defined in Claim 1, further comprising: ID card reading and printing means connected to said apparatus.

25 8. A coffee bean blending apparatus, as defined in Claim 1, further comprising: label printing means connected to said apparatus.

9. A coffee bean blending apparatus, as defined 30 in Claim 1, wherein: at least one of said plurality of storage bins has disposed therein an agitator to prevent bridging of said coffee beans as said coffee beans are discharged from said at least one of said plurality of storage bins.

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10. A coffee bean blending apparatus, as defined in Claim 1, further comprising: each of said storage bins having associated therewith level indicating means to indicate when said each of said storage bins is full 5 and when a given quantity remains.

11. A coffee bean blending apparatus, as defined in Claim 1, wherein: said discharging means is a rotary vane type valve and distal edges of vanes of said valve 10 have attached thereto sheets of mylar to engage inner walls of said valve to prevent the jamming of said discharged coffee beans.

12. A coffee bean blending apparatus, as defined in Claim 2, wherein: said flavoring means flavors said discharged coffee beans with a selected one of a plurality of flavorings available in said flavoring means.

20 13. A method of blending coffee beans, comprising:

- (a) selectively activating mechanical discharging means to discharge coffee beans from a plurality of storage bins; and
- 25 (b) collecting discharged coffee beans from said discharging means and selectively conveying said discharged coffee beans to at least a first dispensing location.

30 14. A method of blending coffee beans, as defined in Claim 13, further comprising the step of: flavoring said discharged coffee beans at said at least a first dispensing location as said discharged coffee beans are dispensed.

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15. A method of blending coffee beans, as defined in Claim 13, further comprising the step of: alternatively conveying said discharged coffee beans to a second dispensing location and grinding said 5 discharged coffee beans at said second dispensing location as said discharged coffee beans are dispensed.

16. A method of blending coffee beans, as defined in Claim 14, wherein: said step of flavoring includes 10 flavoring said coffee beans with a selected one of a plurality of flavors available at second first dispensing location.

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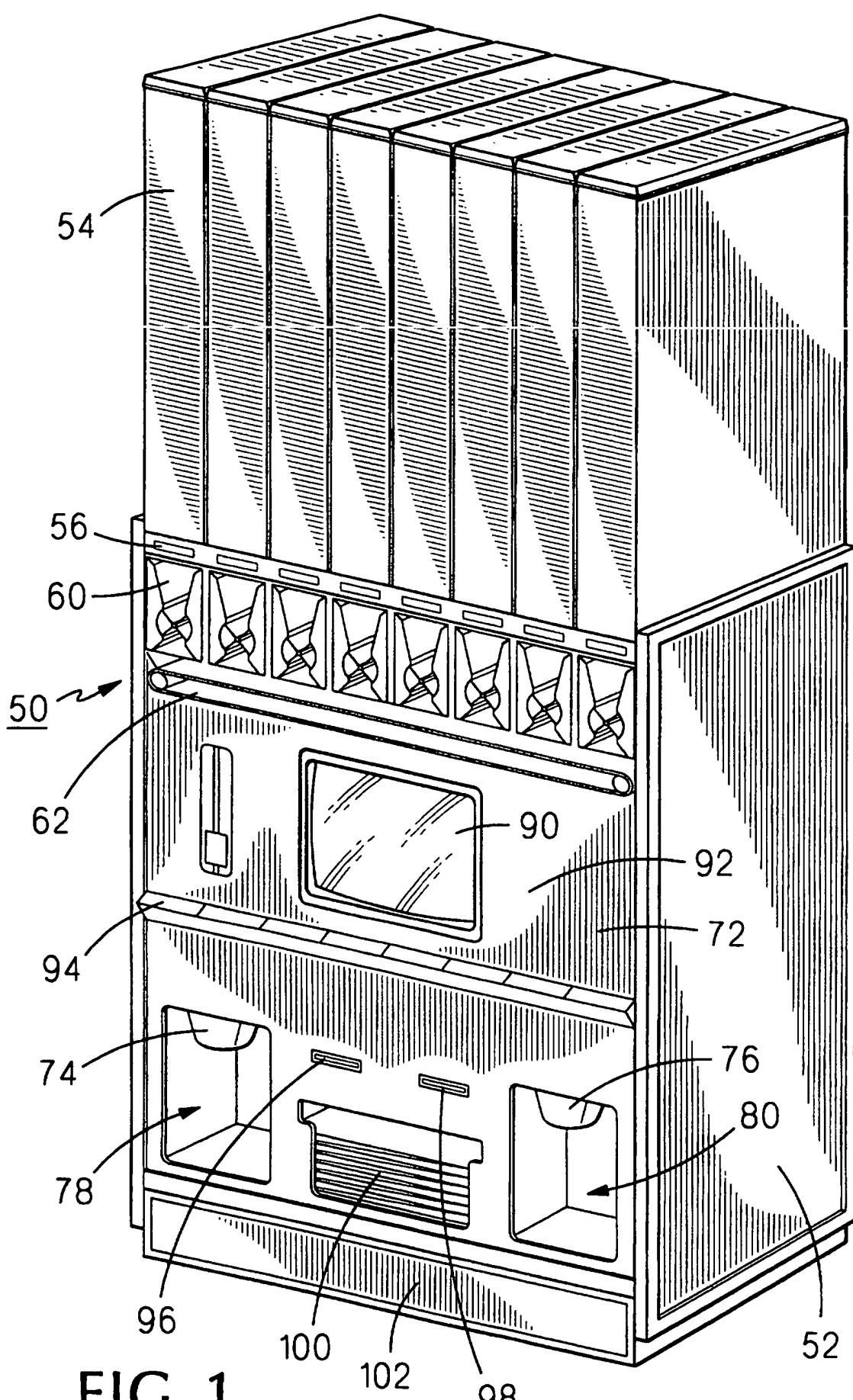


FIG. 1

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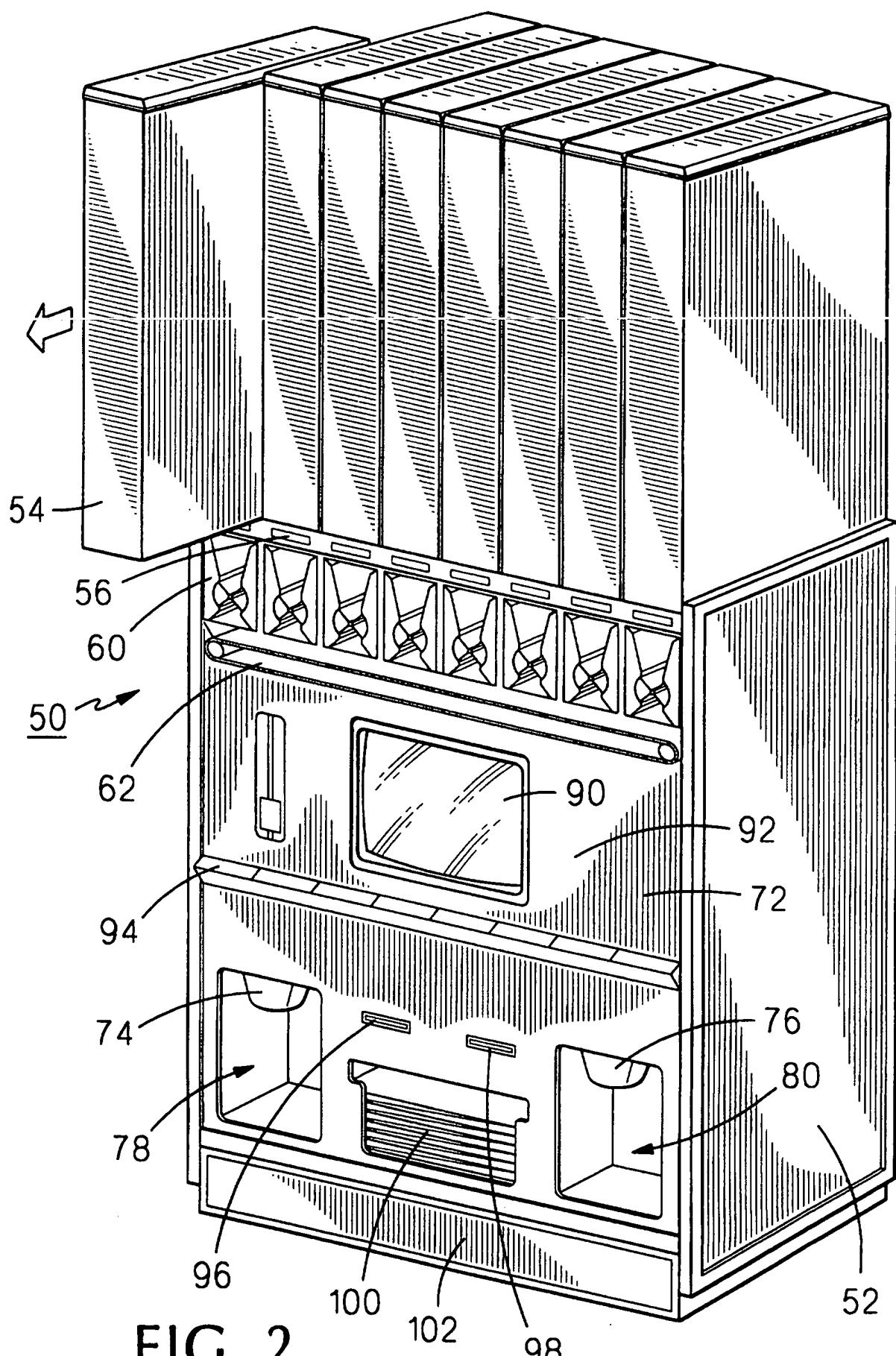


FIG. 2

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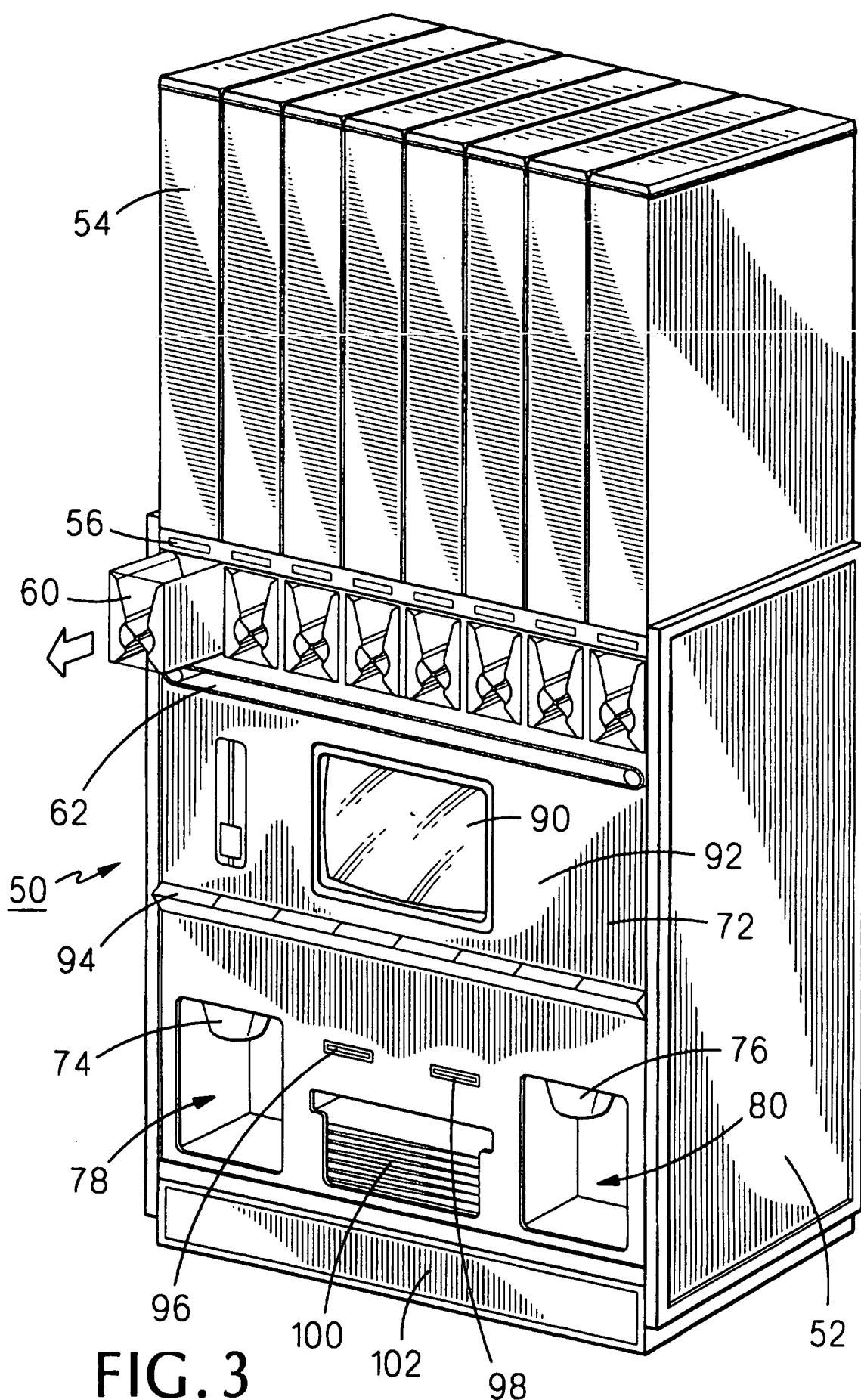


FIG. 3

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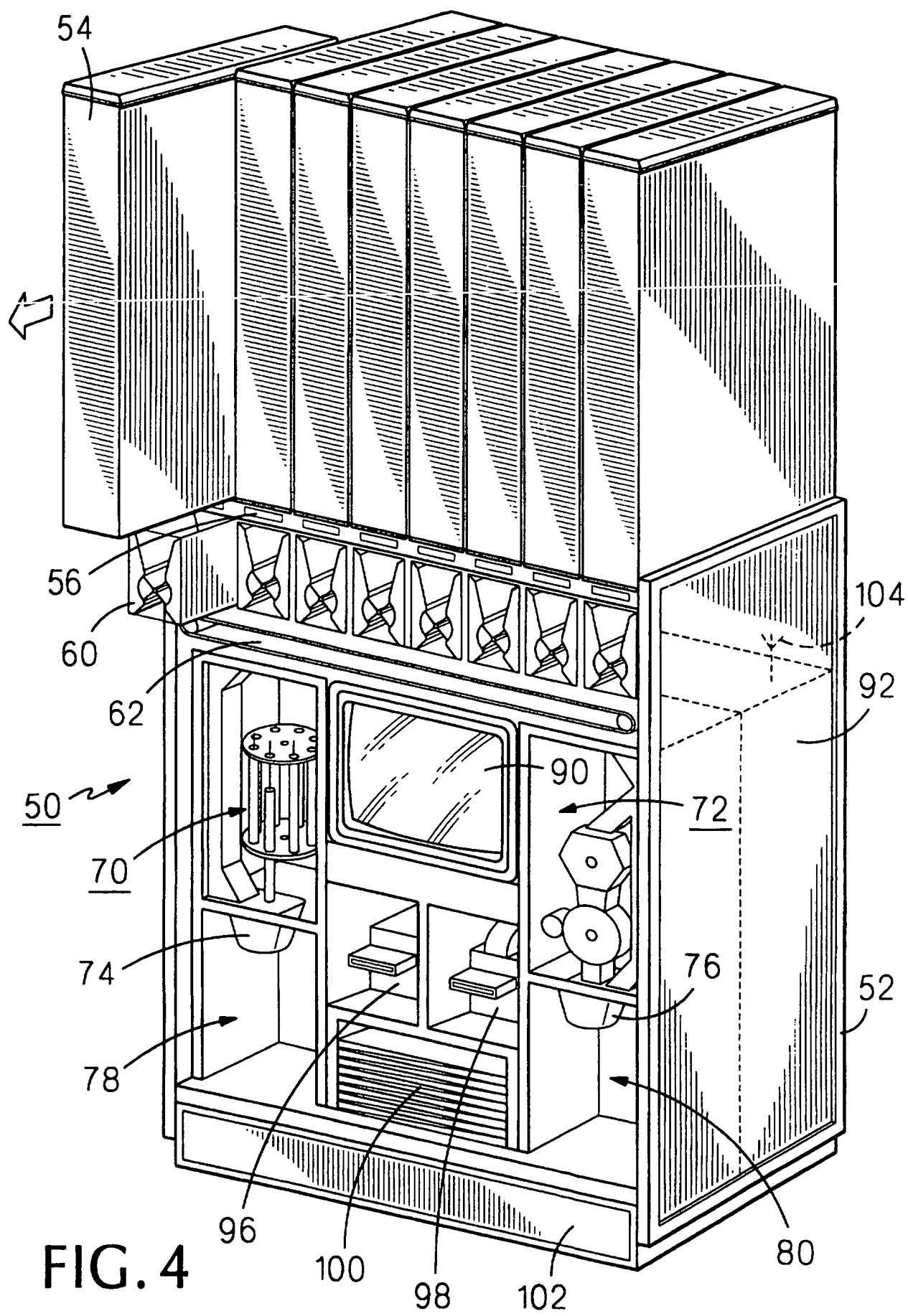
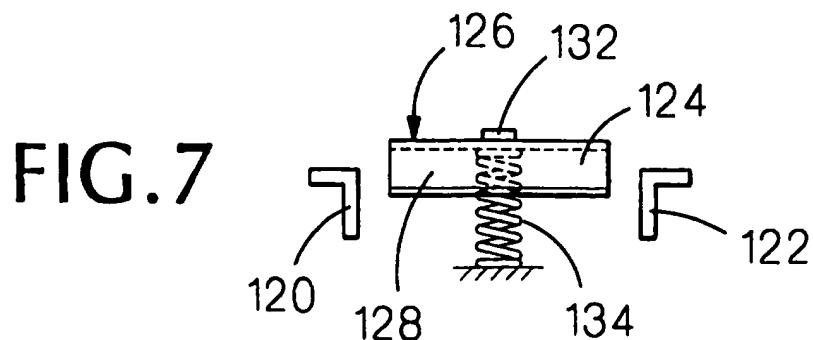
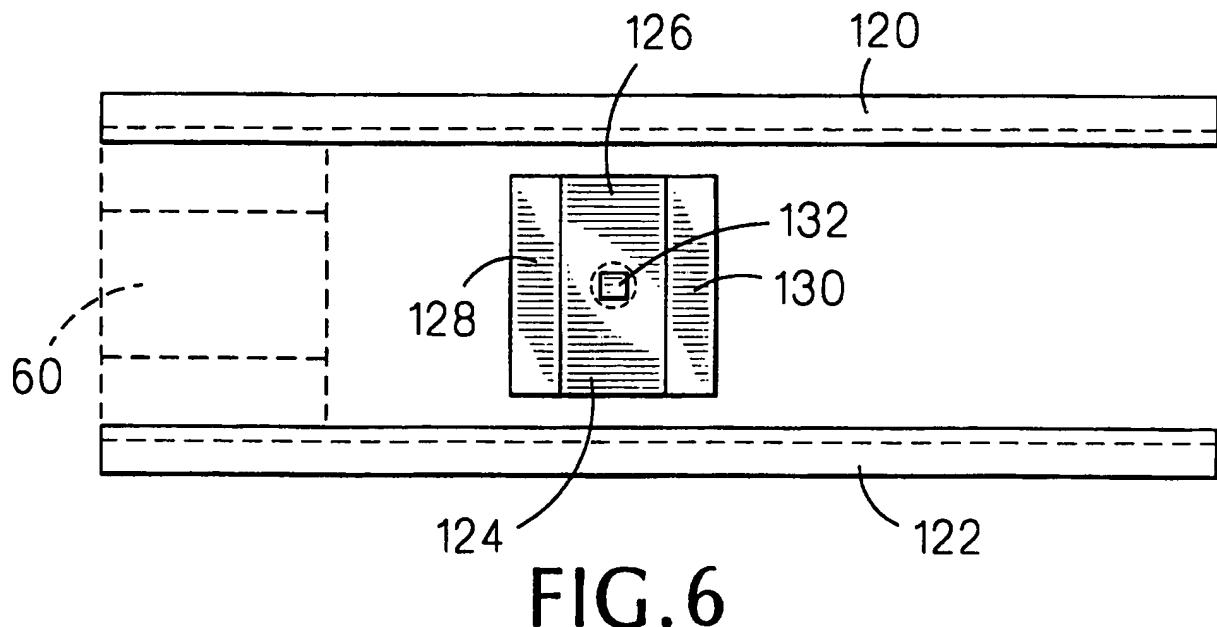
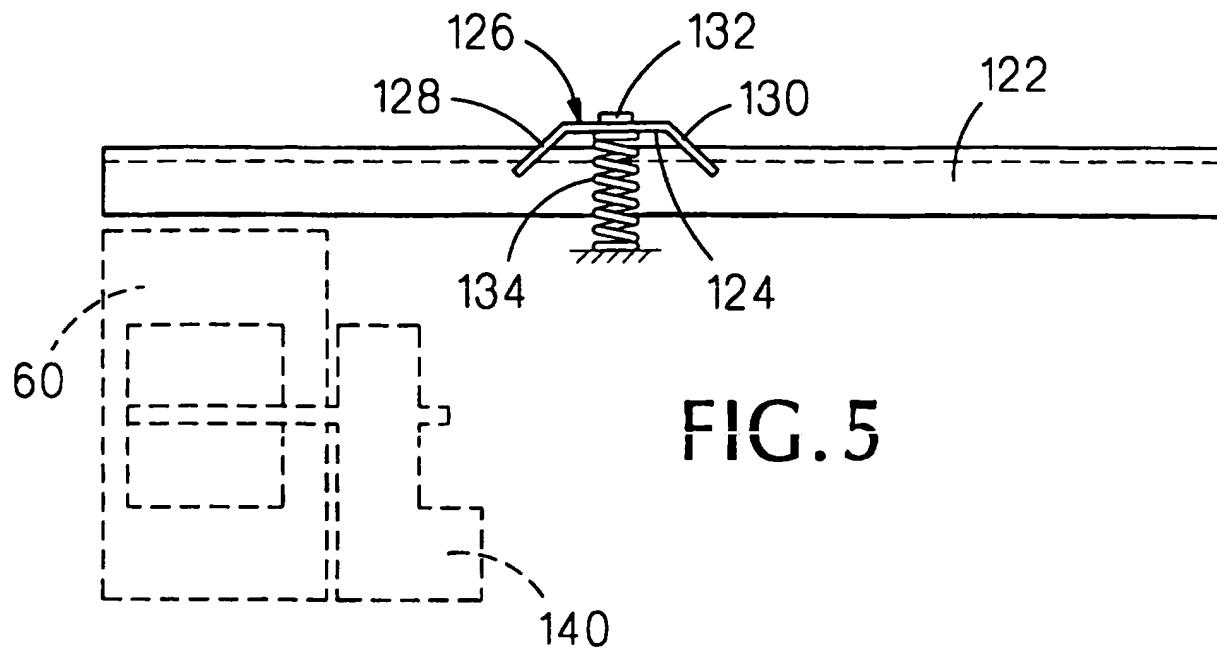


FIG. 4

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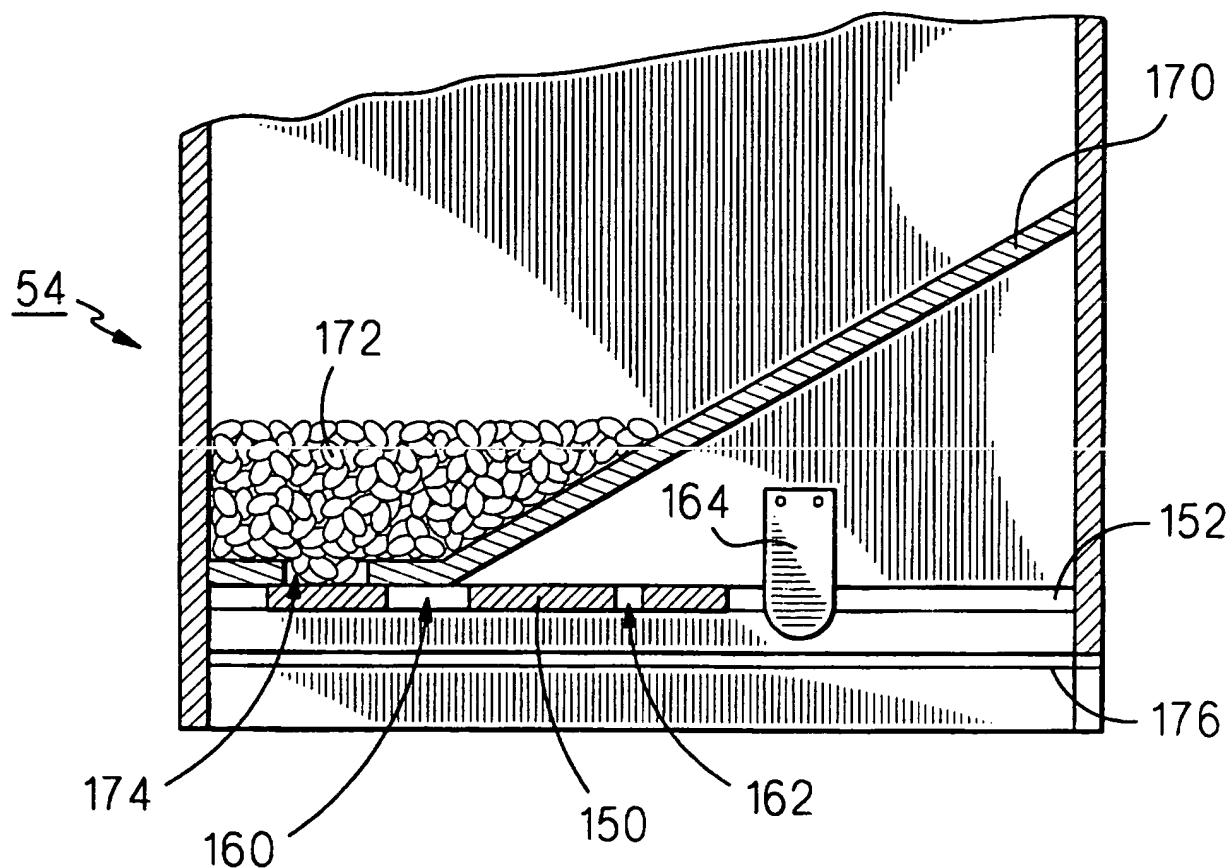


FIG. 8

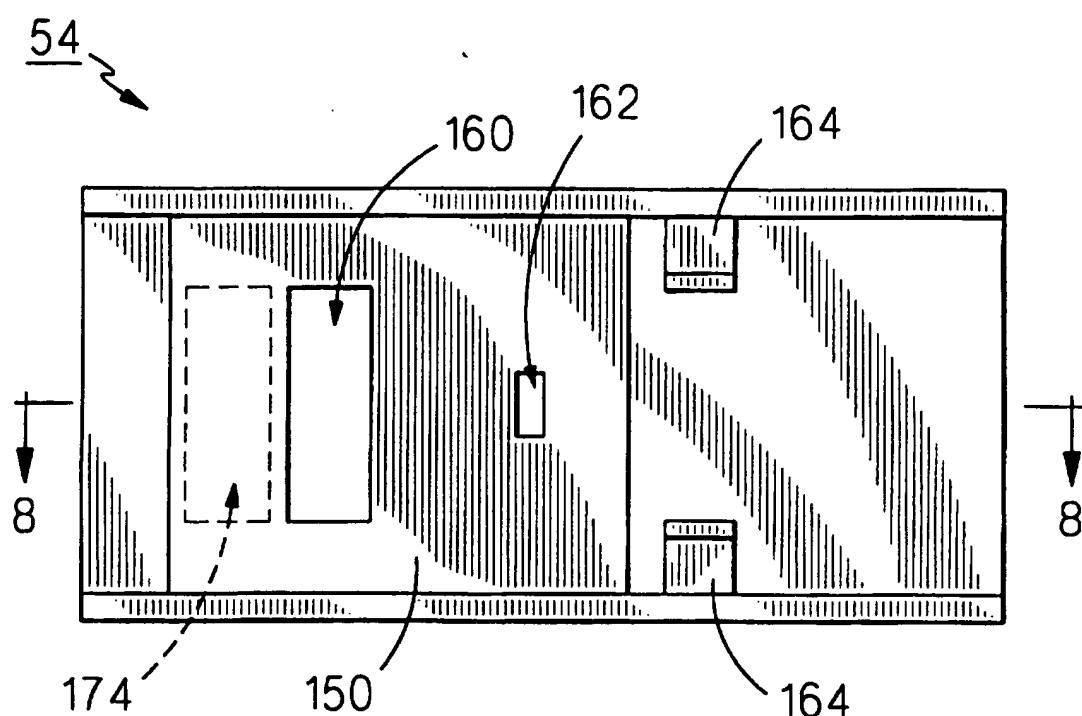


FIG. 9

SUBSTITUTE SHEET (RULE 26)

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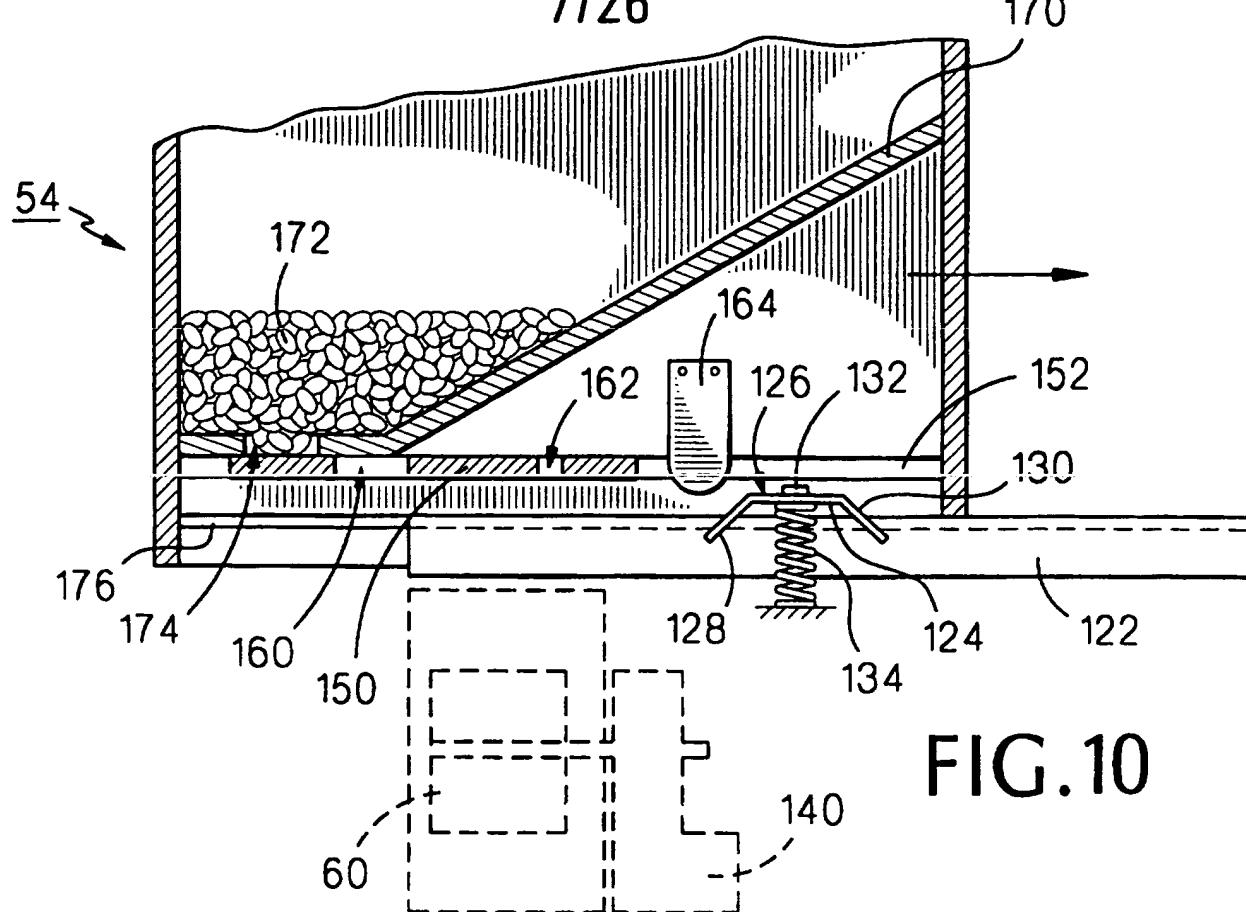


FIG. 10

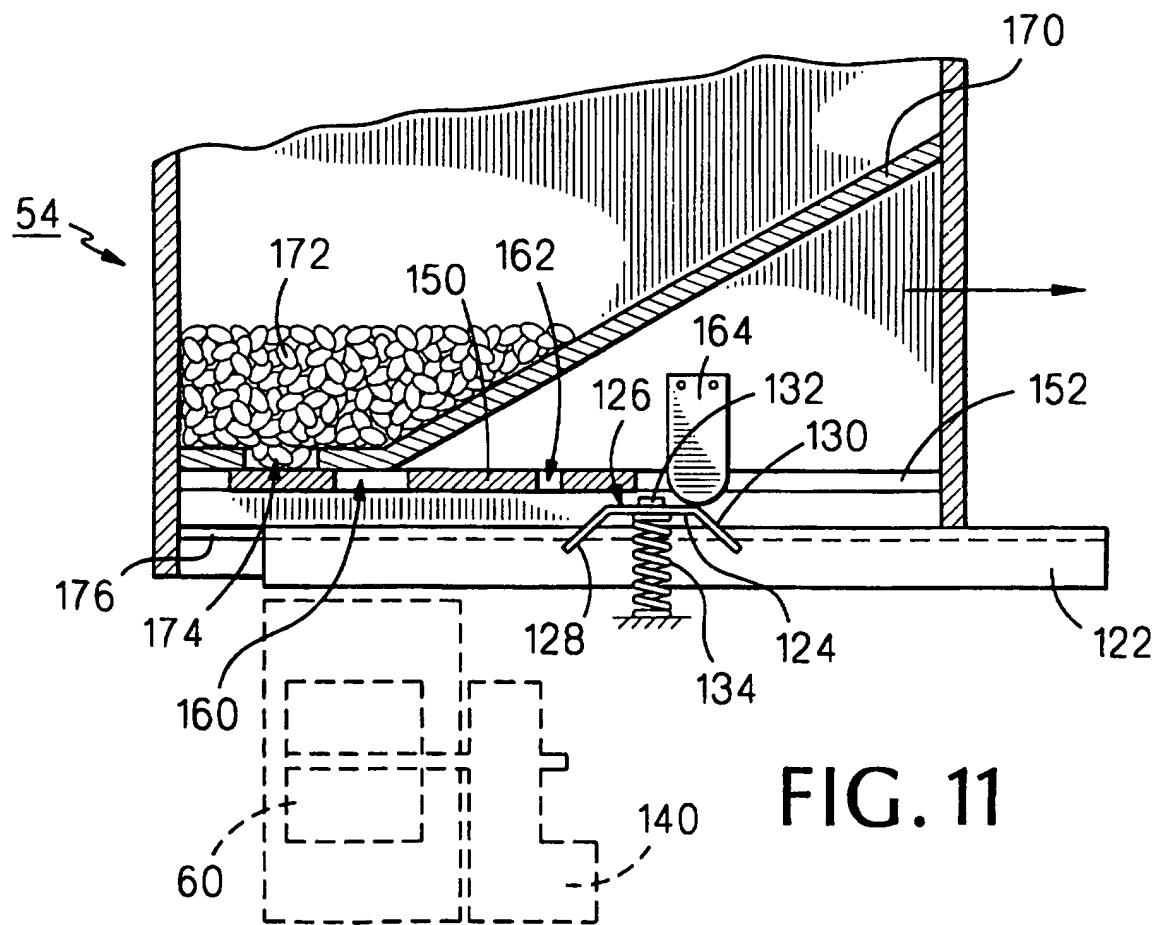
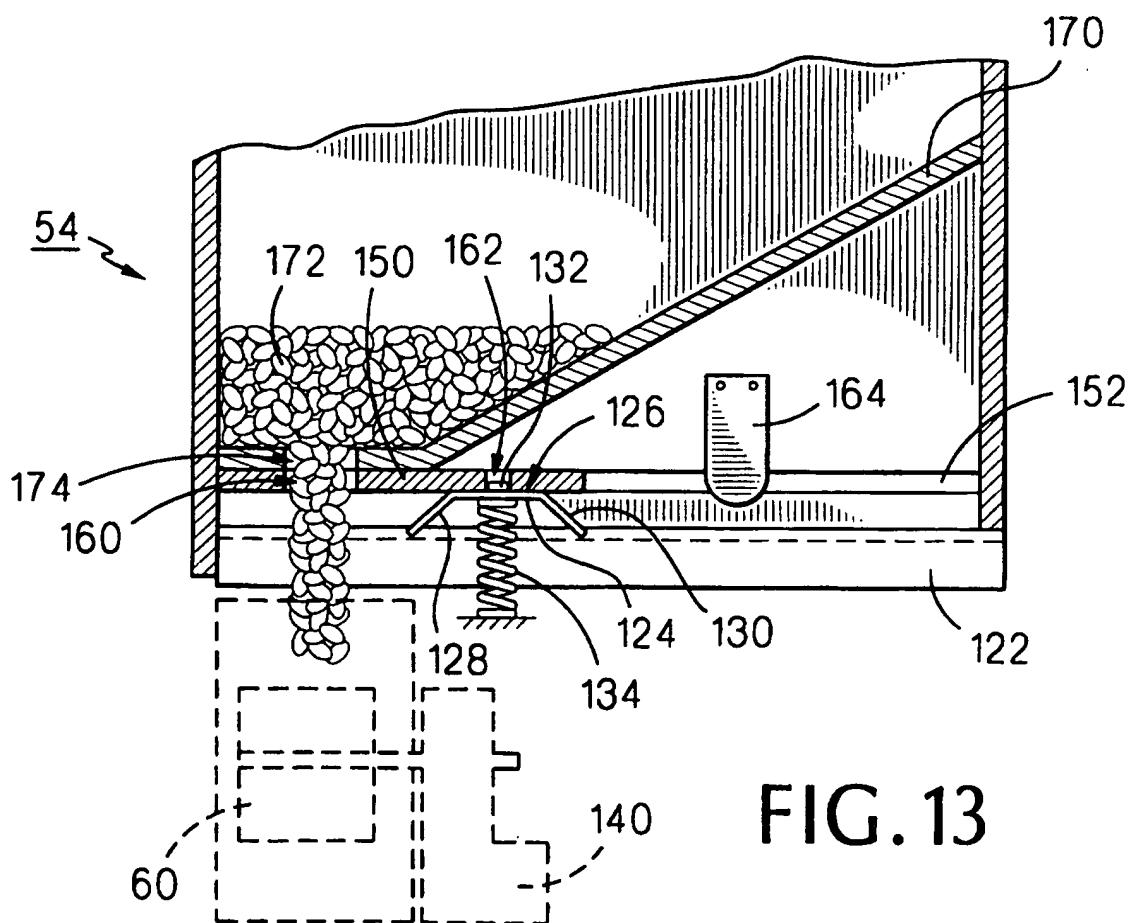
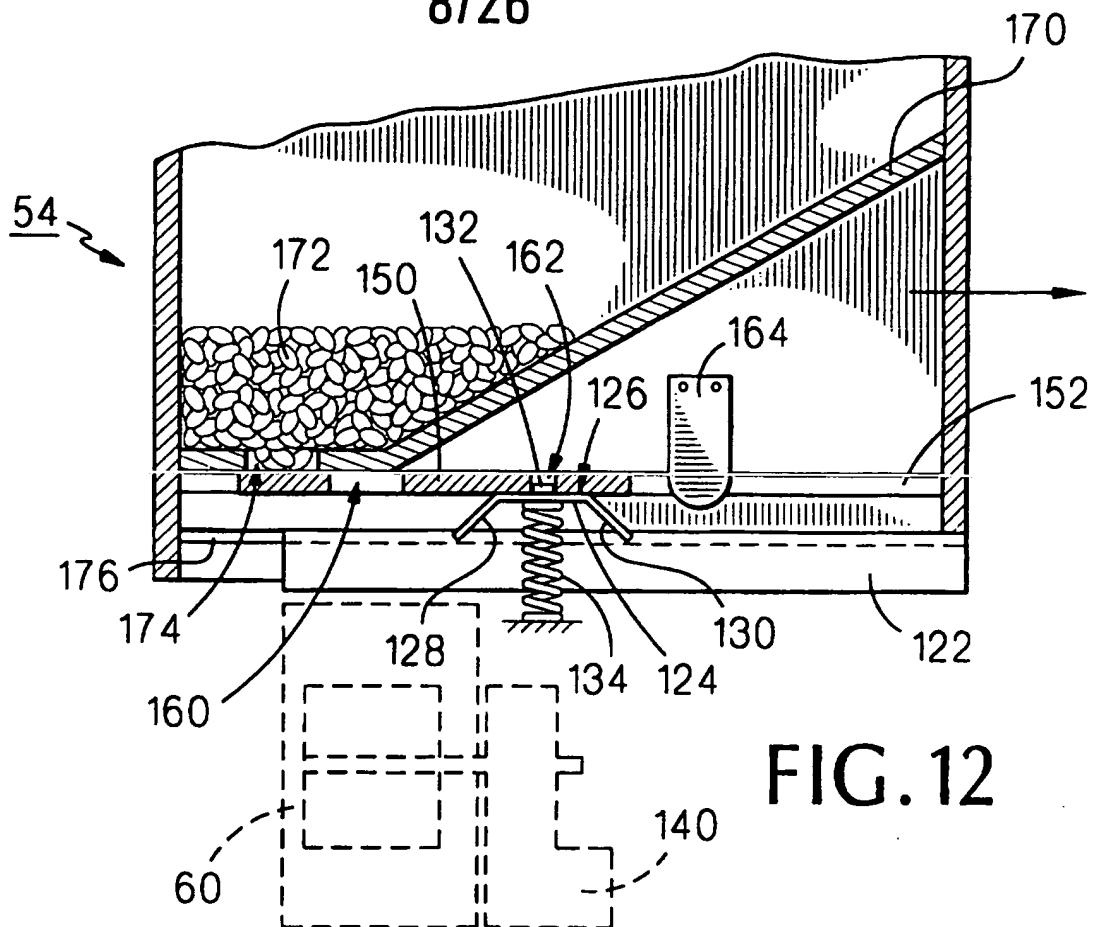


FIG. 11

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SUBSTITUTE SHEET (RULE 26)

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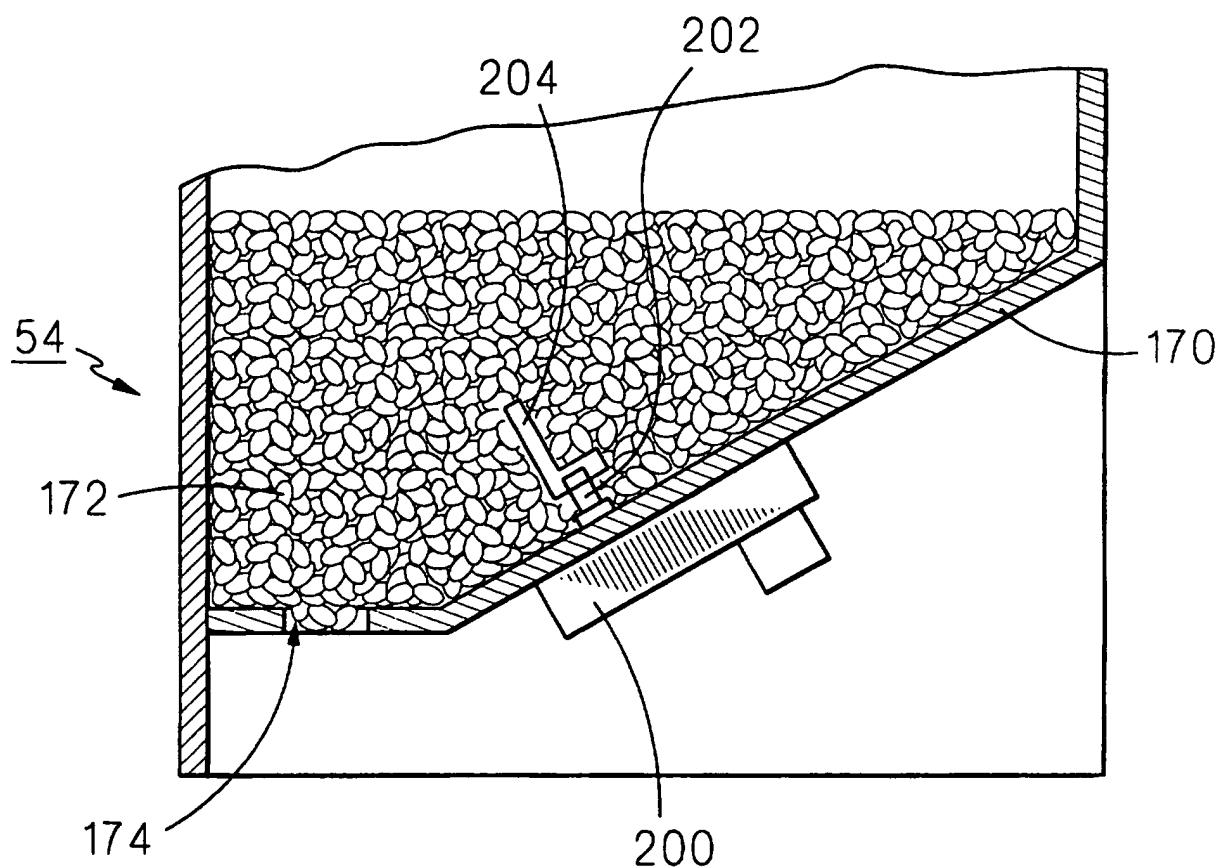


FIG.14

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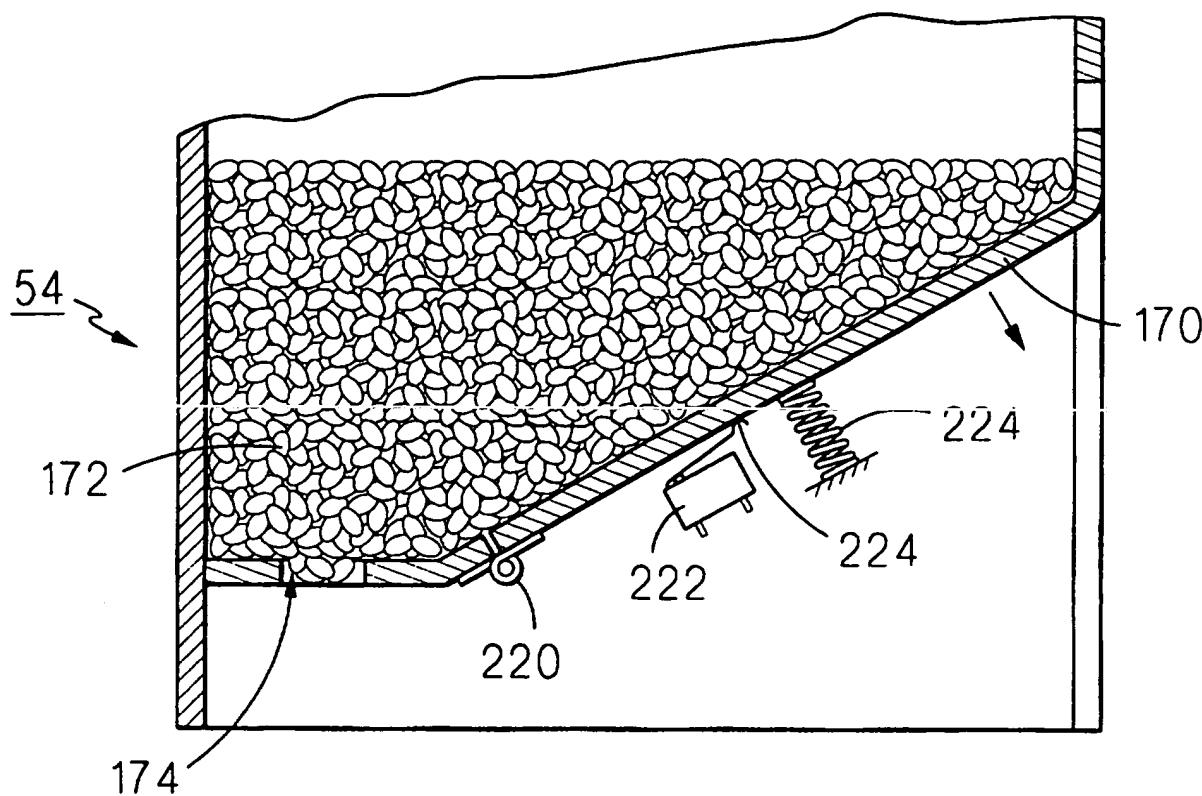
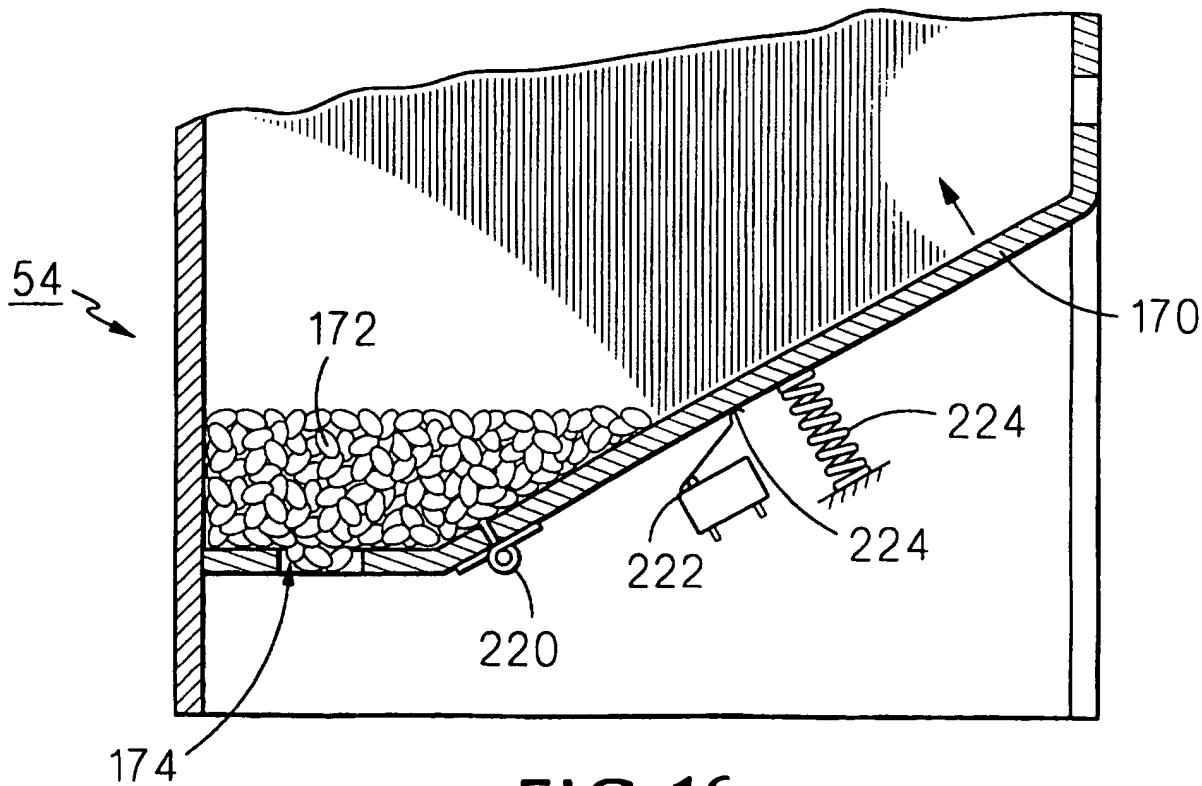


FIG. 15

FIG. 16  
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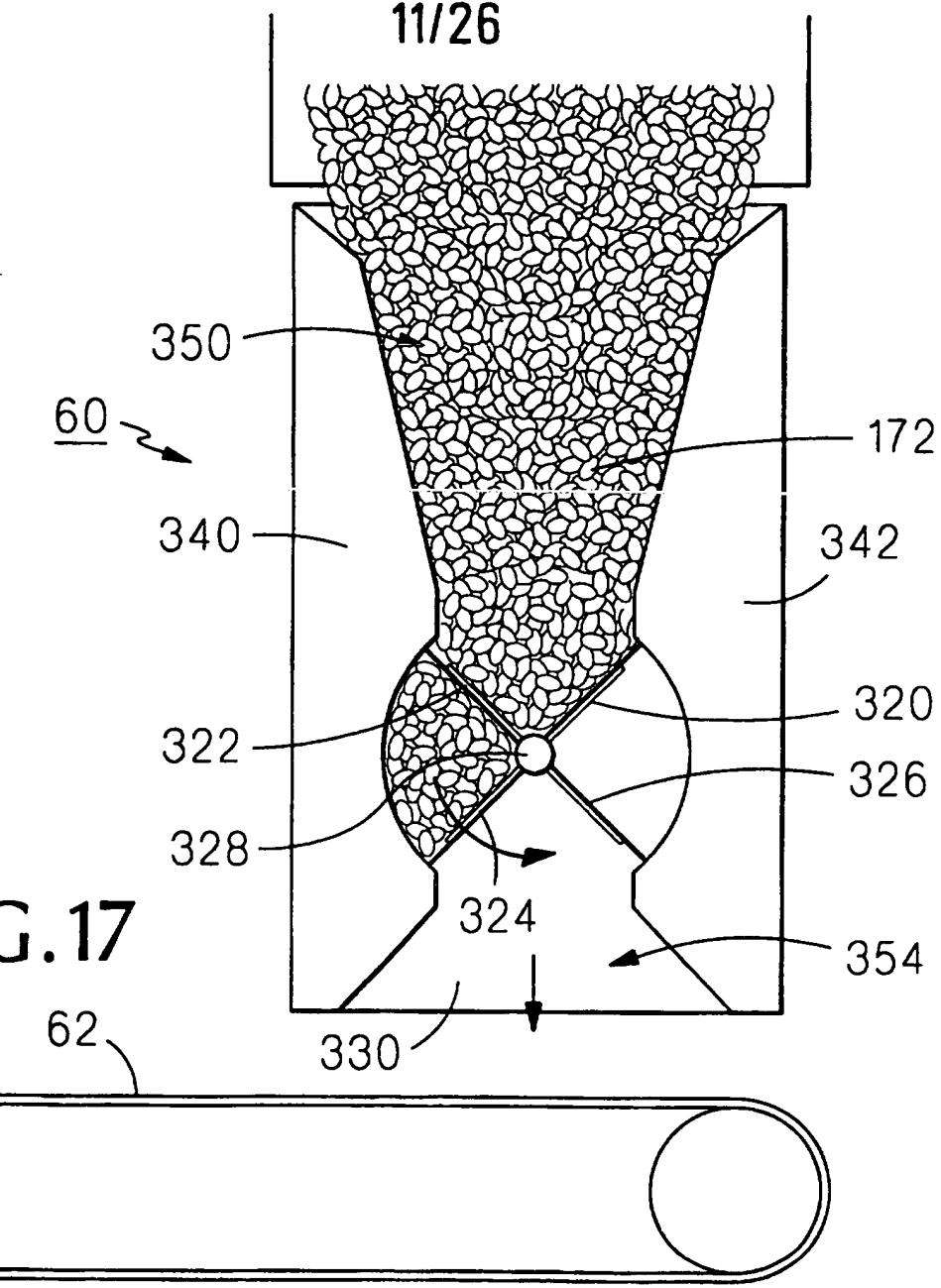


FIG. 17

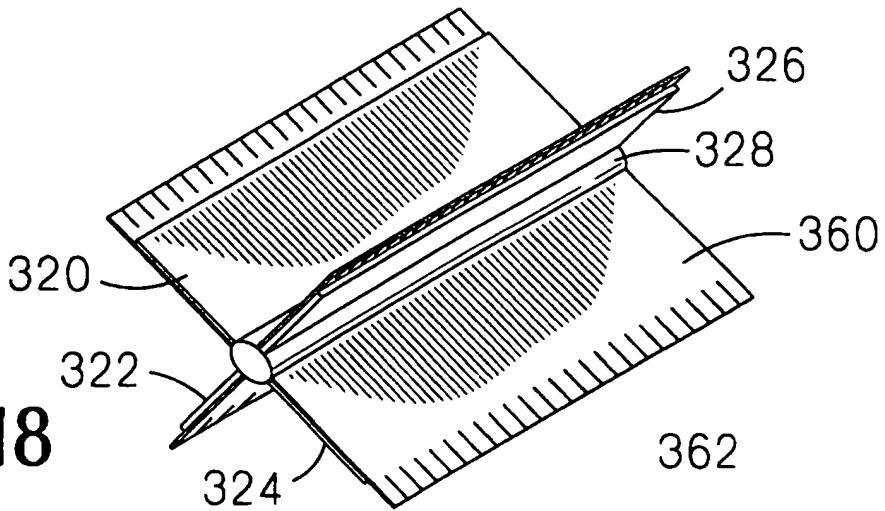


FIG. 18

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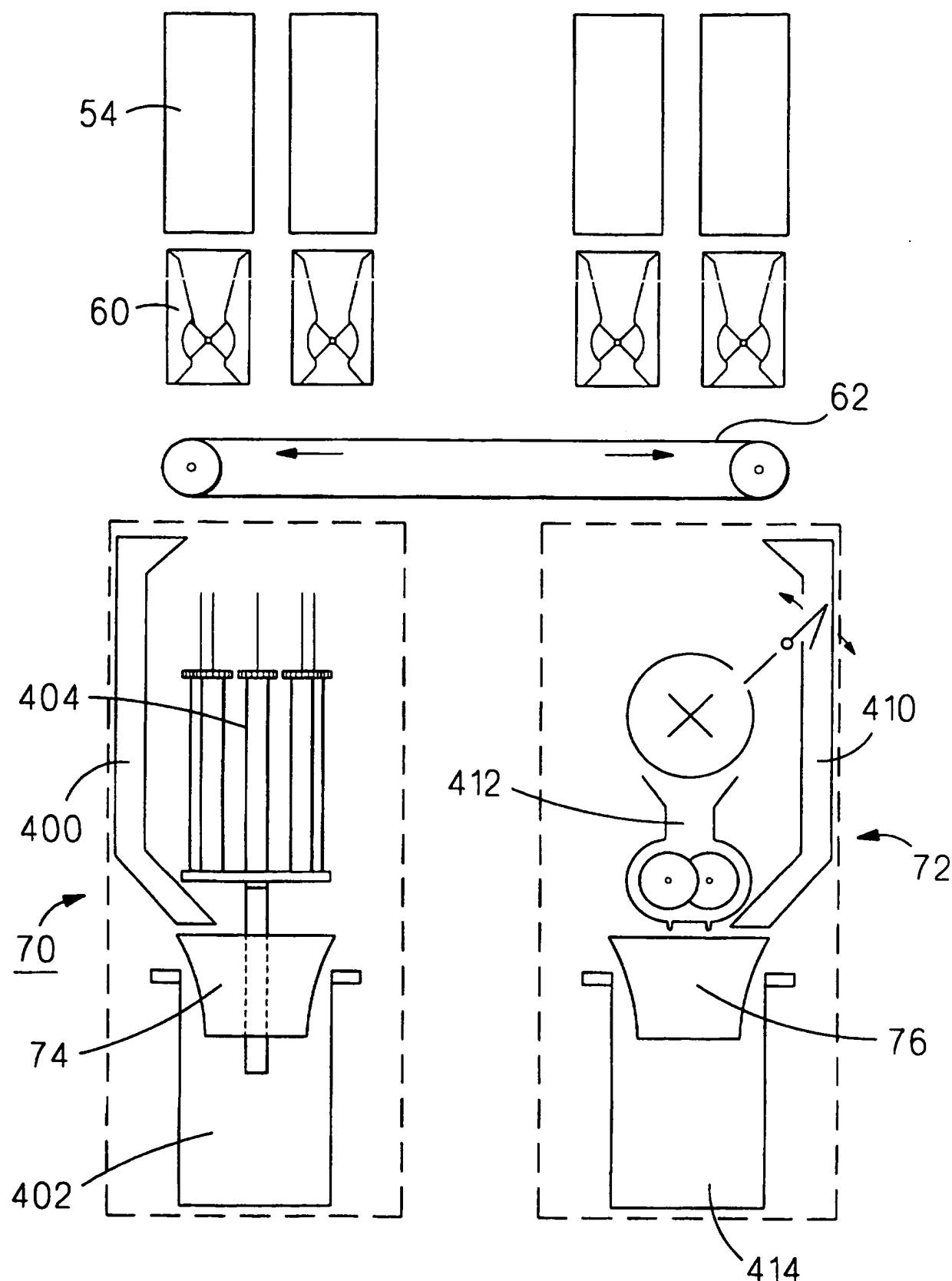


FIG. 19

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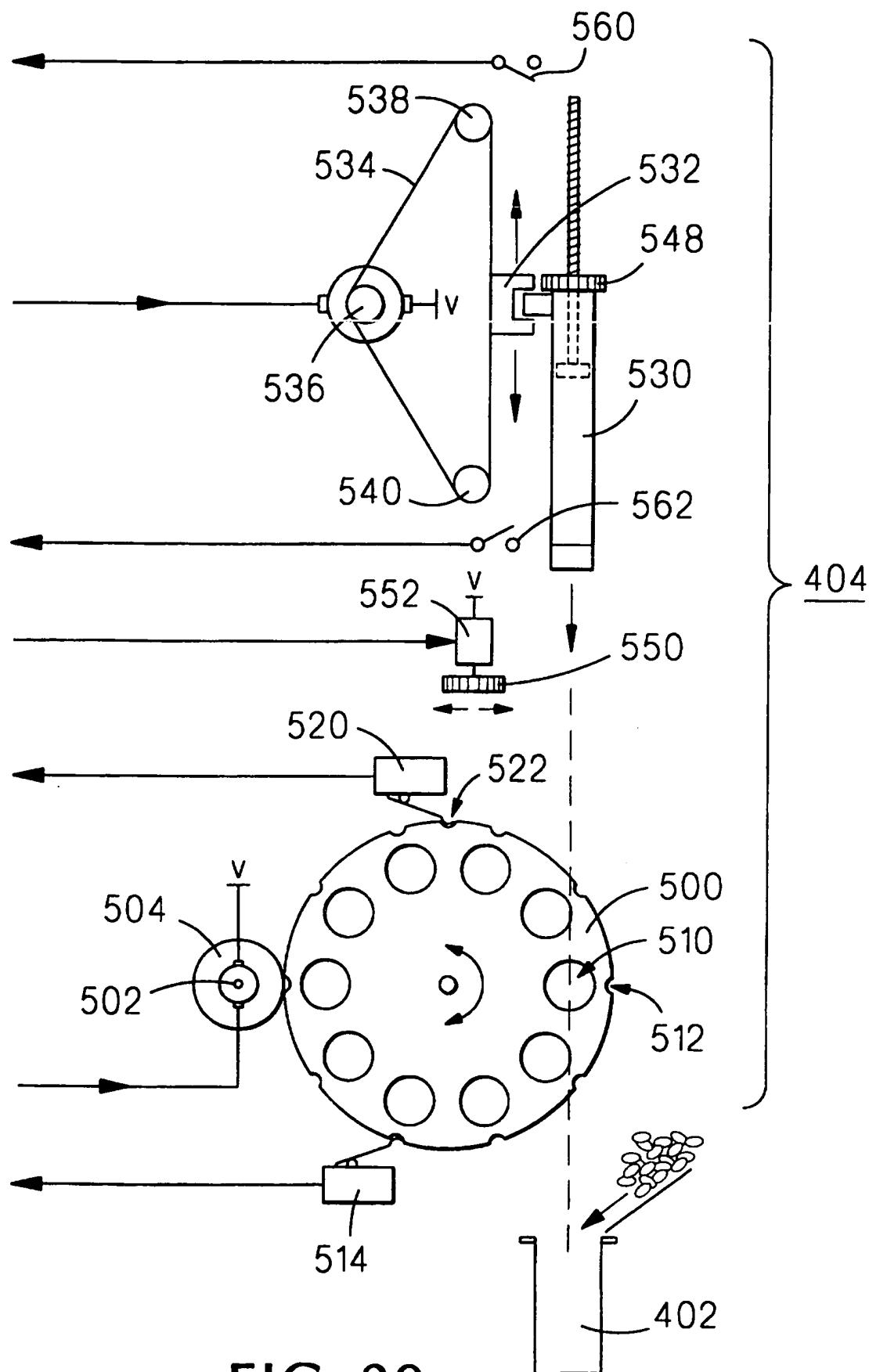


FIG. 20

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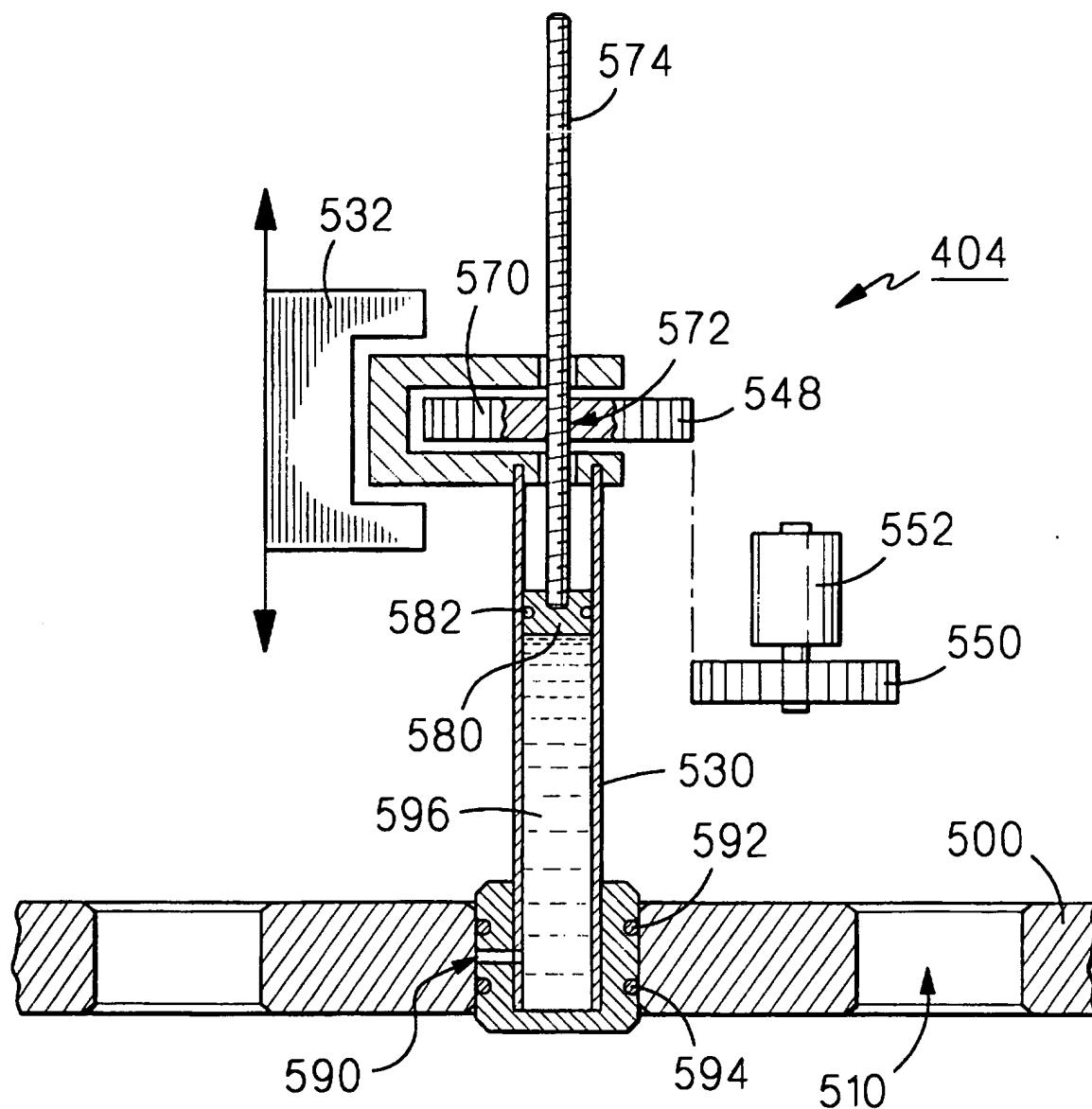
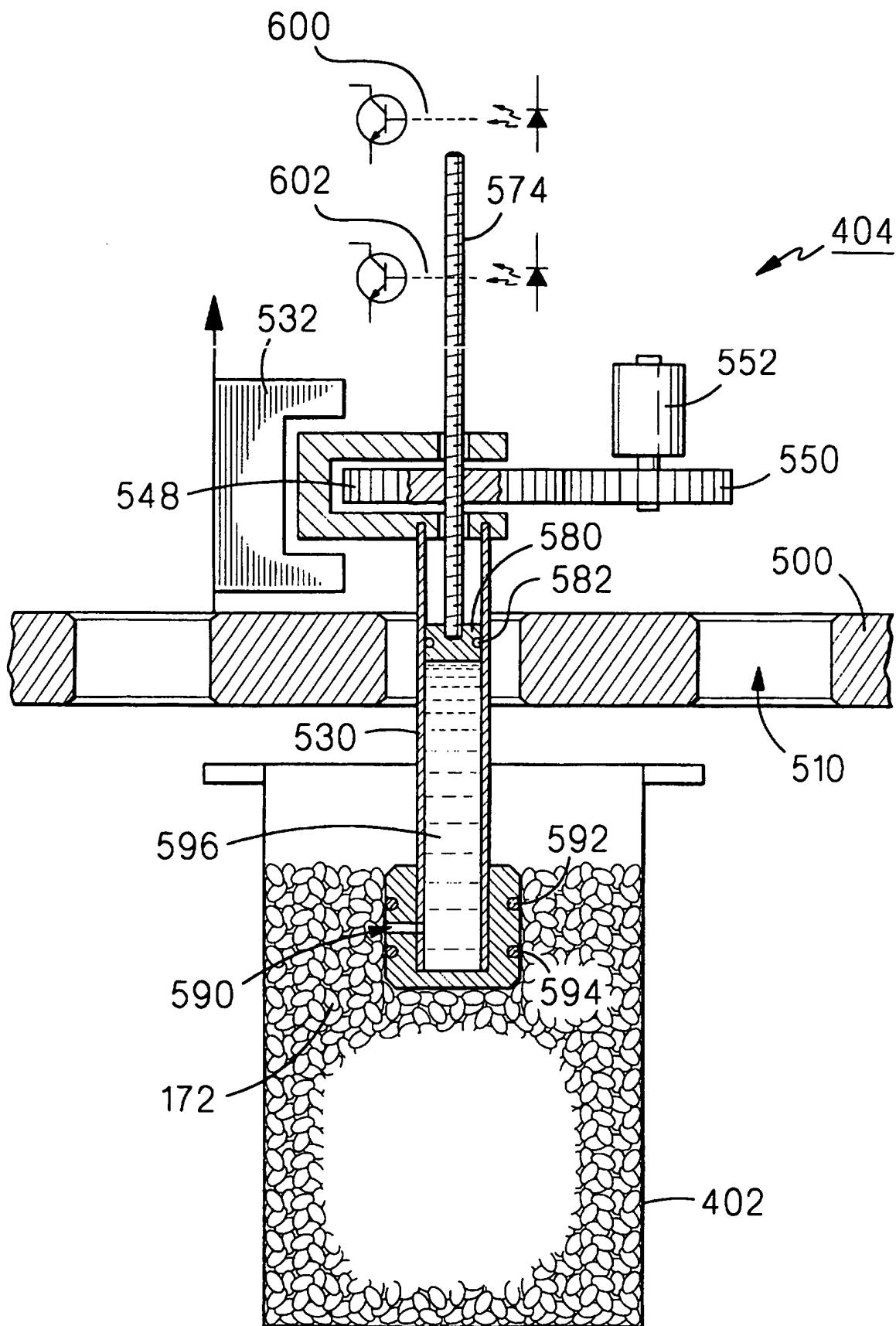


FIG. 21

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**FIG. 22**  
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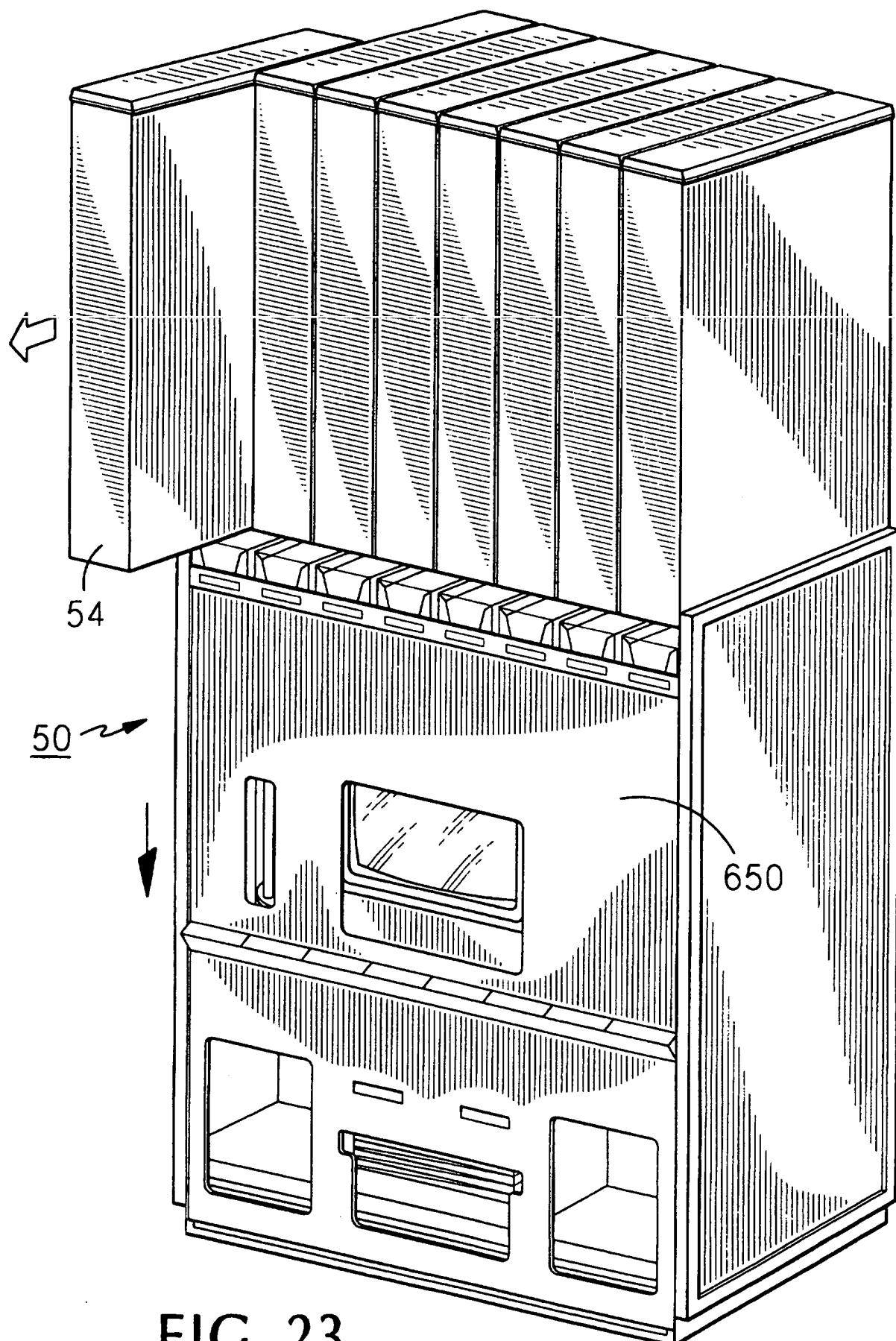


FIG. 23

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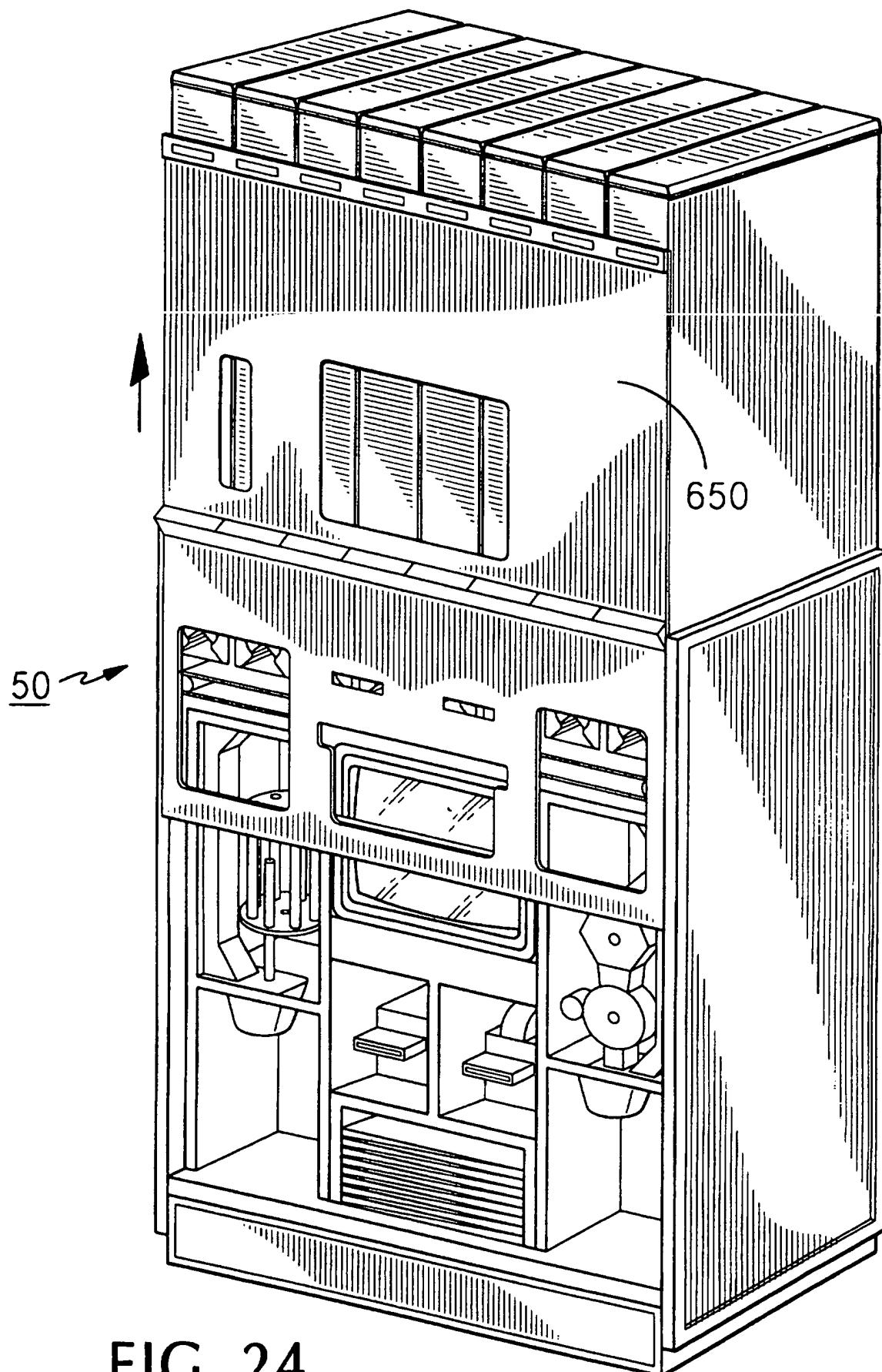
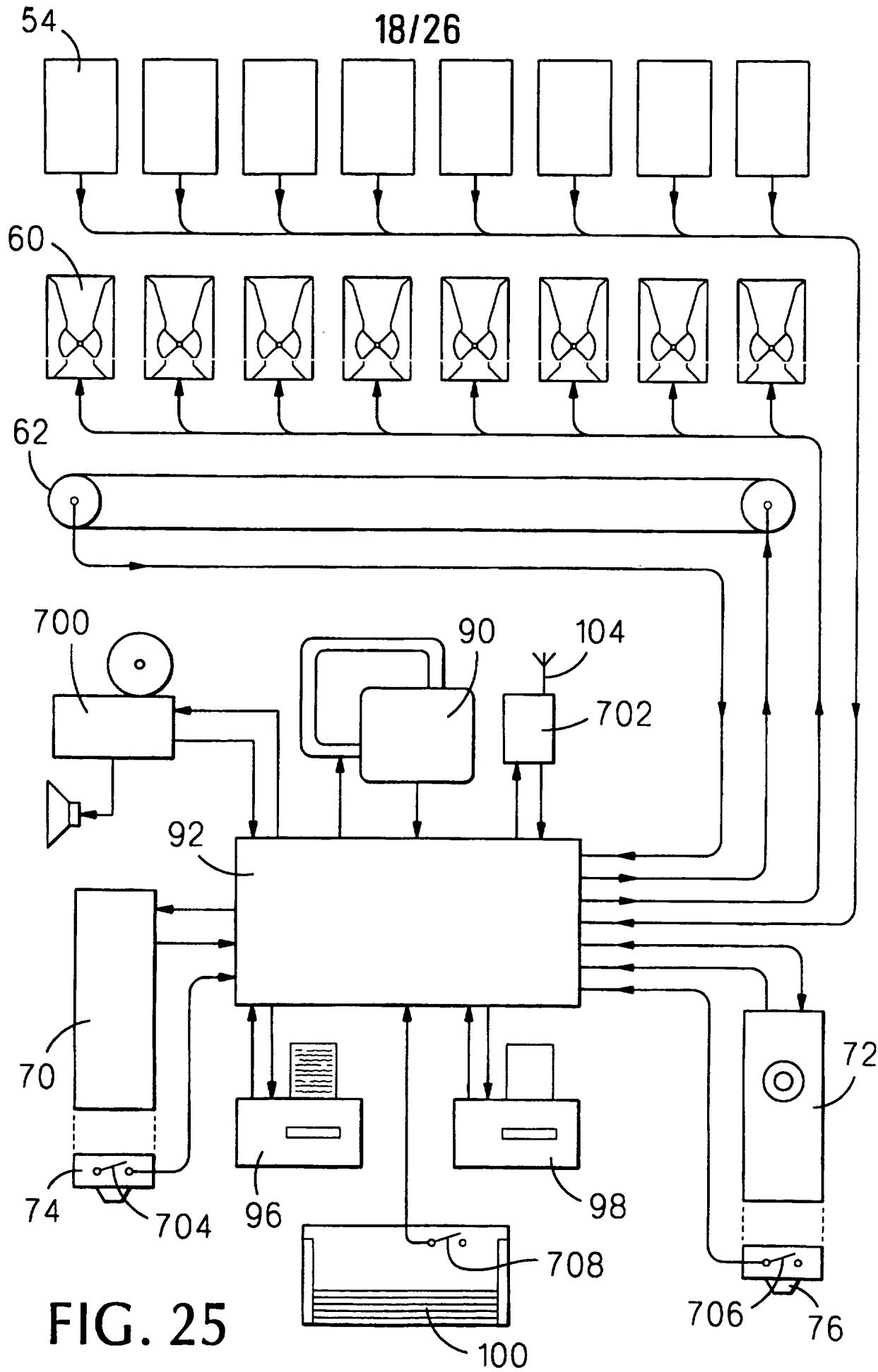


FIG. 24

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## Gourmet Coffee Dispensing Machine Flowchart

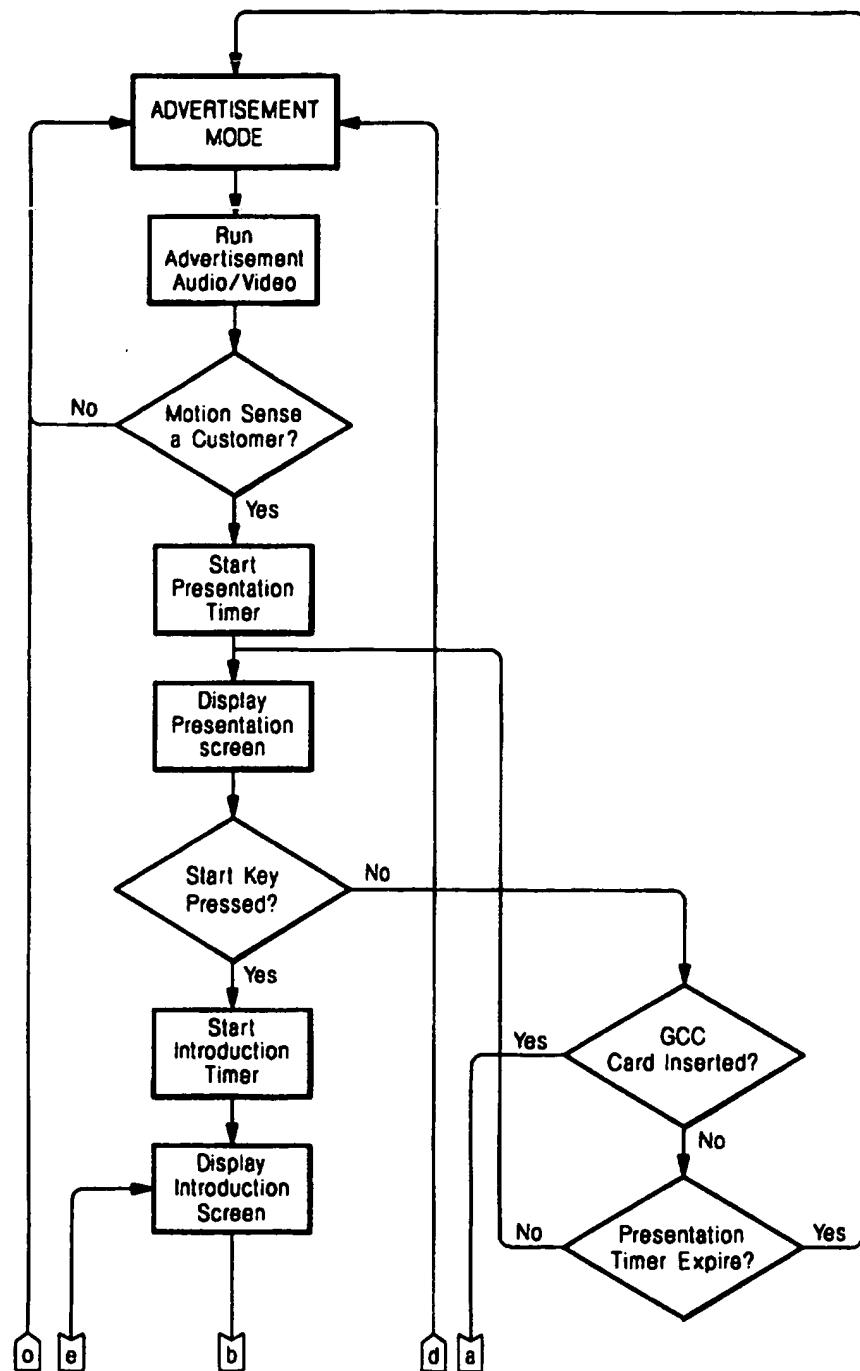
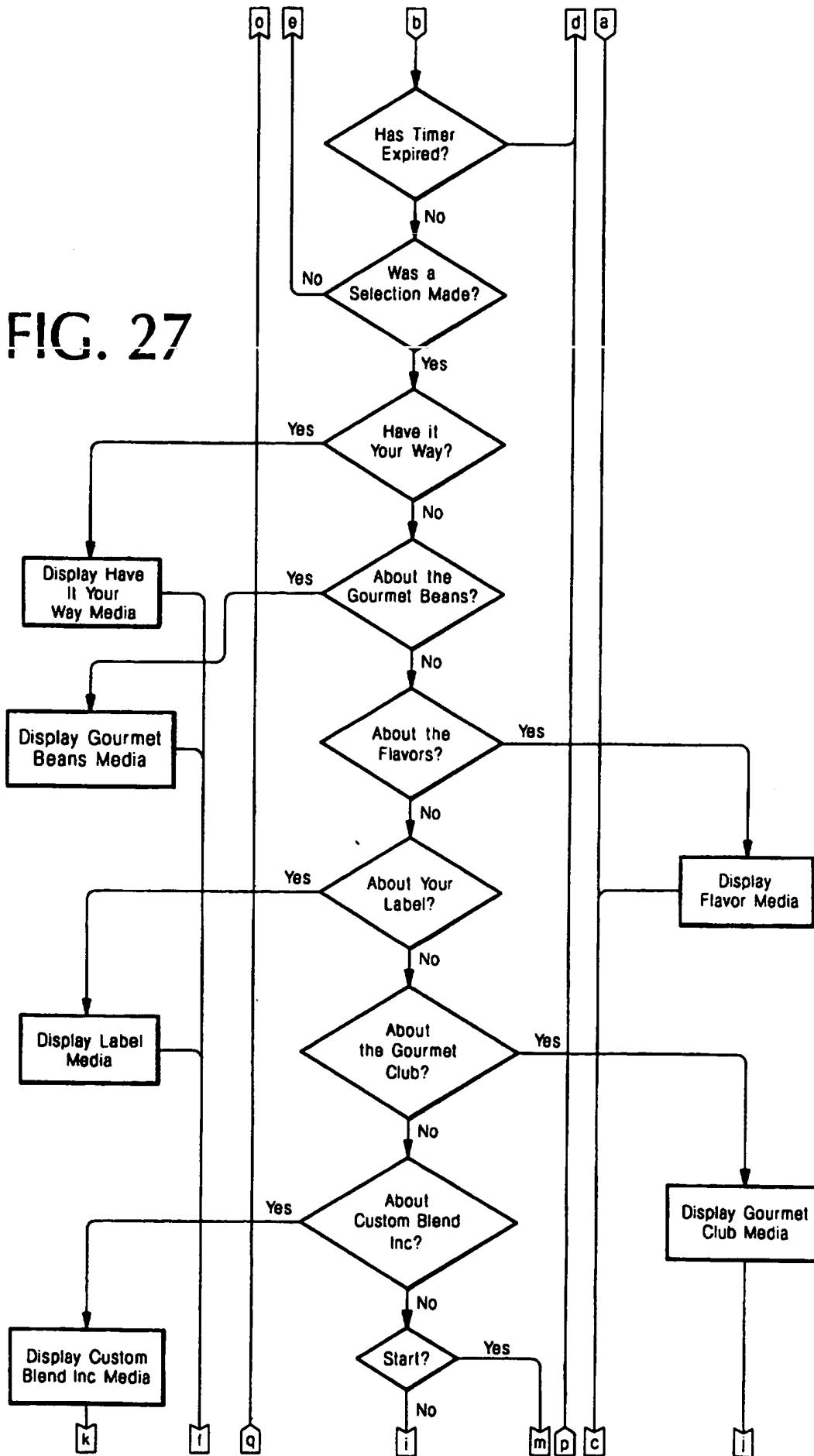


FIG. 26

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FIG. 27



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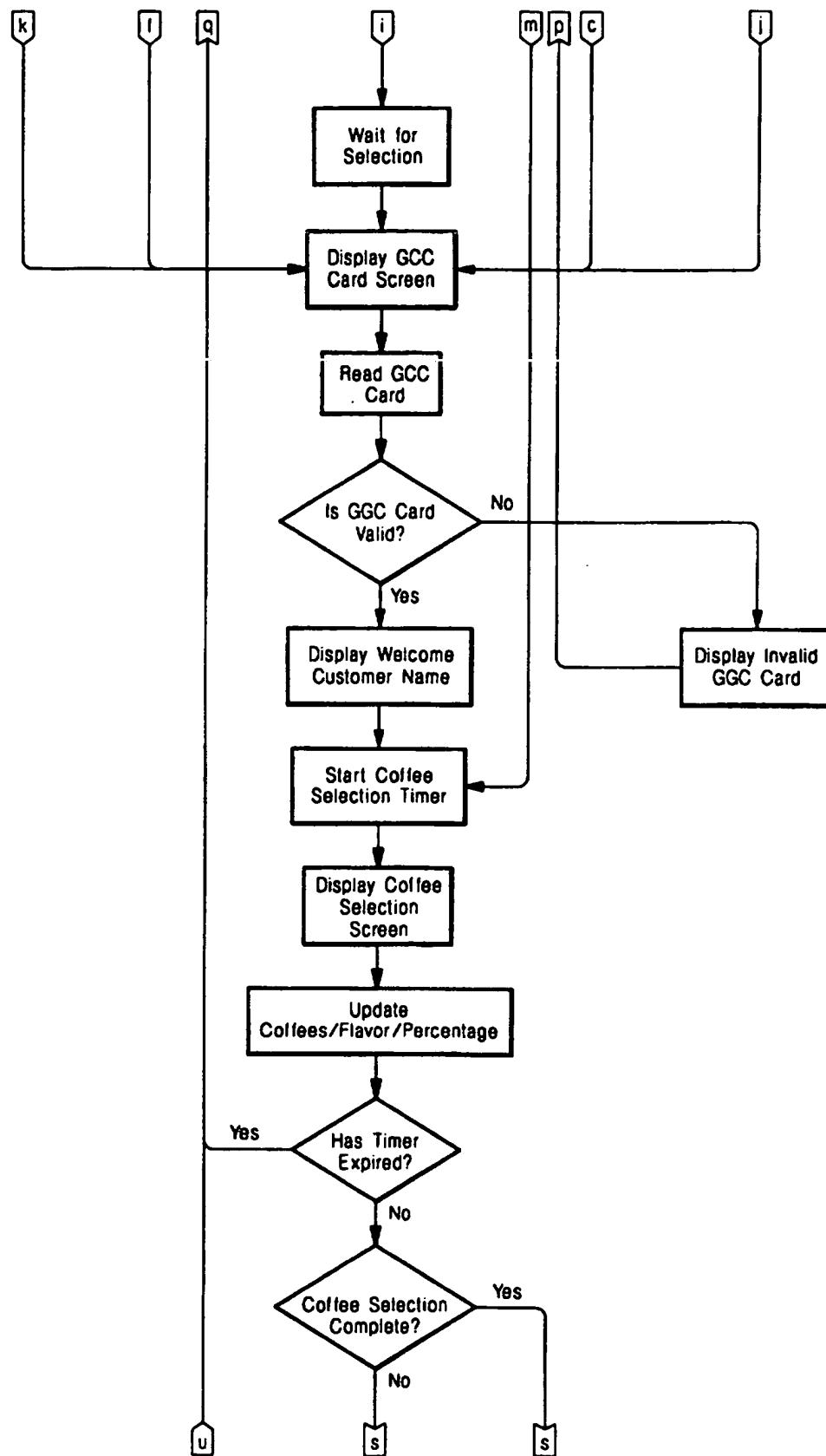


FIG. 28

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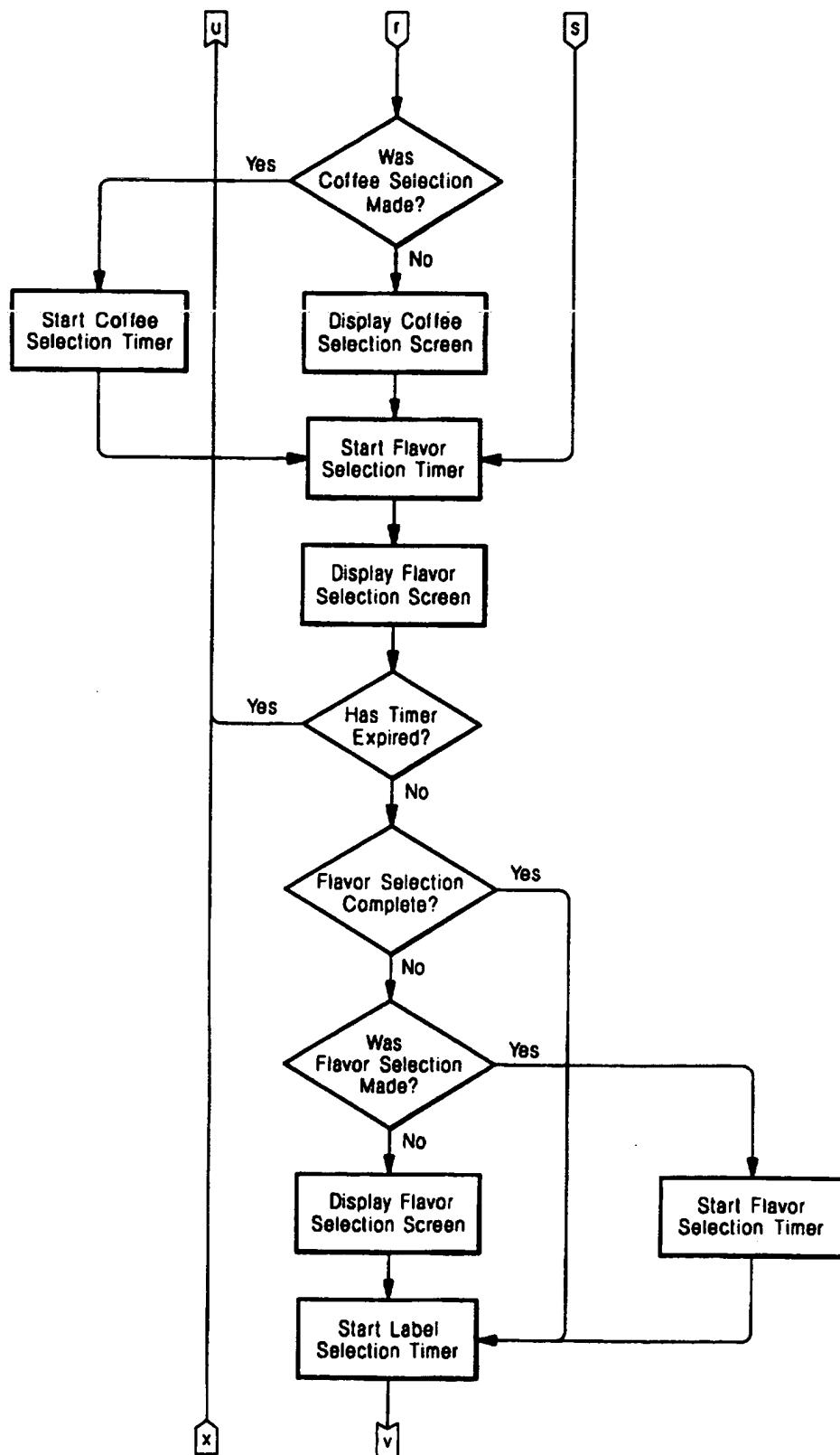


FIG. 29

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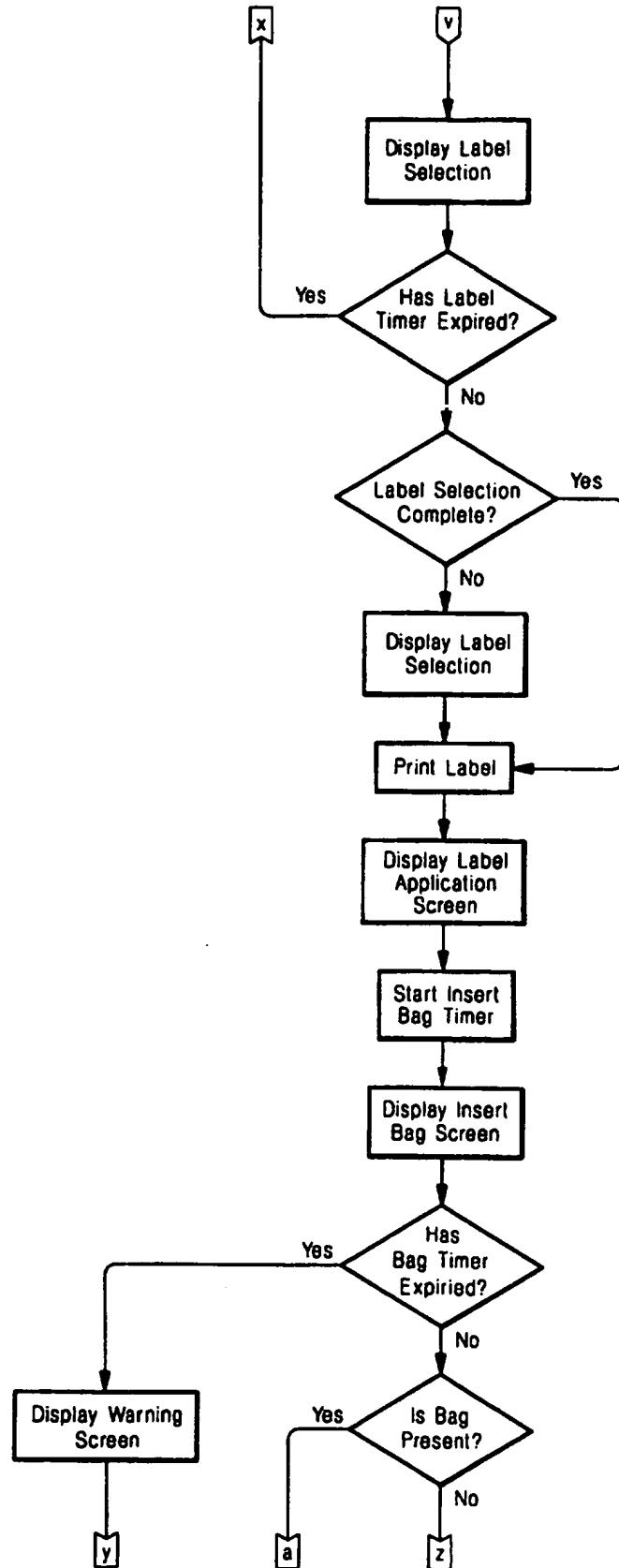


FIG. 30

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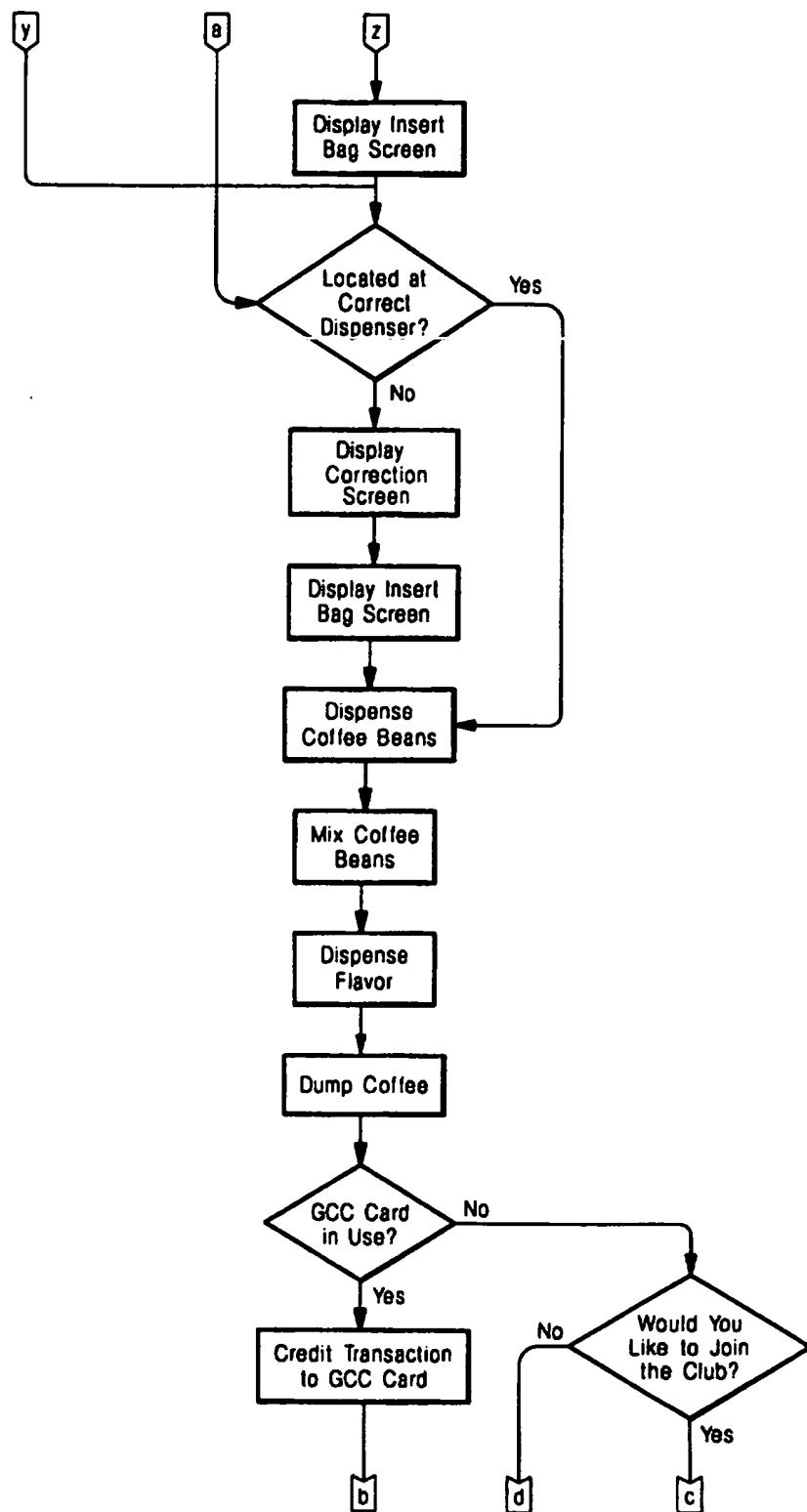


FIG. 31

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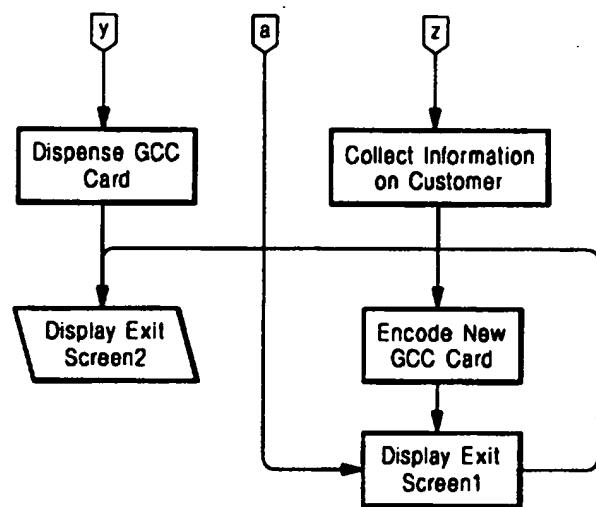


FIG. 32

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FIG. 33

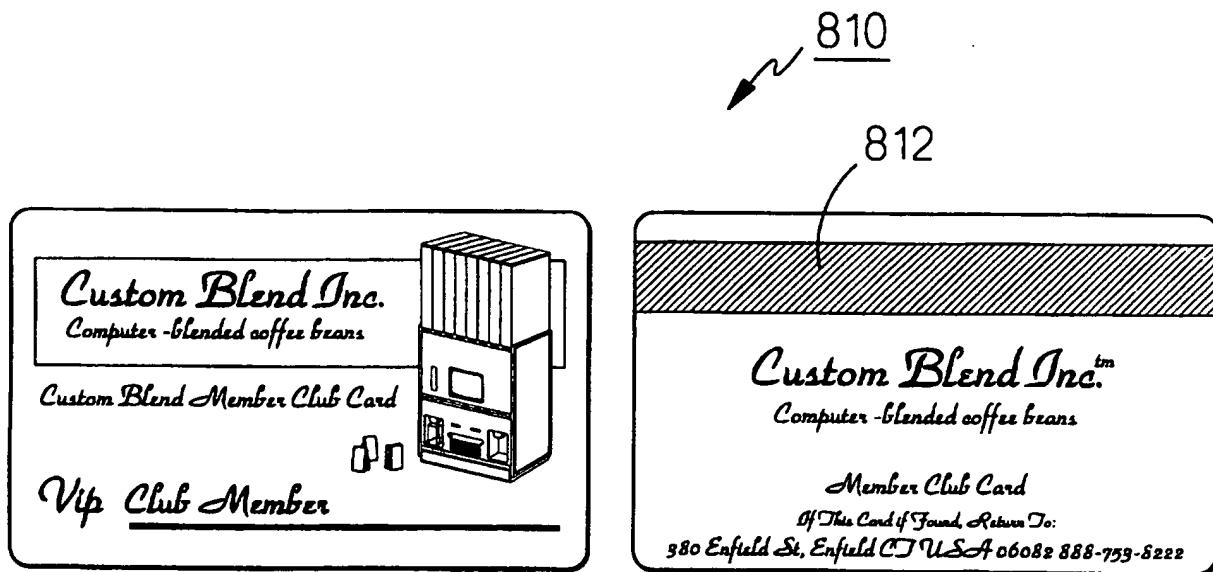


FIG. 34

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/US97/07344

## A. CLASSIFICATION OF SUBJECT MATTER

IPC(6) :A47J 37/00

US CL :099/485, 279, 286, 287, 516

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 099/484, 485, 483, 348, 279-323, 516, 534  
366/177.1, 181.1-181.3

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

NONE

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

NONE

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 3,799,049 A (SMITH JR.) 26 MARCH 1974, see entire document.	1-16
A	US 4,204,464 A (STROBEL) 27 MAY 1980, see entire document.	1-16
A	US 4,815,633 A (KONDO ET AL.) 28 MARCH 1989, see entire document.	1-16

Further documents are listed in the continuation of Box C.

See patent family annex.

•	Special categories of cited documents:	"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
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•O*	document referring to an oral disclosure, use, exhibition or other means		
•P*	document published prior to the international filing date but later than the priority date claimed		

Date of the actual completion of the international search

17 JUNE 1997

Date of mailing of the international search report

24 JUL 1997

Name and mailing address of the ISA/US  
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